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THE LUMINOUS EFFICIENCY OF INCANDESCENT LAMPS.

Various attempts have been made by observers at different times to determine the proportion of luminous radiation to the total power emitted by incandescent lamps in particular, as well as by luminous sources in general. The matter seems very simple at first sight. The total power emitted by an incandescent lamp may be measured with great prevision by a wattmeter applied to its terminals. All we have then to do is to find the number of watts in its light rays, and we can get the ratio of the latter to the former from a slide-rule in a few seconds. This ratio is the luminous efficiency of the incandescent lamp considered. But it is very difficult to measure the number of watts in the visible radiation of such a lamp, and the estimates of luminous efficiency that have been made differ greatly. Angström has estimated that the luminous efficiency of a Hefner standard amylacetate lamp under standard conditions is a little less than one per cent (0.9 per cent), and that of the acetylene flame about 5.5 per cent. Everyone admits that the efficiency is very low, and is of this order. In the ordinary flames of candles, lamps and gas jets, we liberate about a hundred times more power as heat than as light, and since the principal purpose of these devices is to give out light, they are extremely inefficient. Measurements of this kind have been made with incandescent lamps by first immersing the lamp in a glass beaker full of water, measuring the heat absorbed by the water in a given time, and then replacing the water in the beaker by ink or other opaque solution and repeating the experiment. It was assumed that, in the first experiment, the luminous rays would penetrate the transparent glass and water, so as to escape into the surrounding air, and not contribute to the heating of the water, while it was likewise assumed that, in the second experiment, all of the radiation from the immersed lamp would be absorbed in heating the liquid. Anyone who tries this experiment will find that there is surprisingly little difference between the two amounts of heat. Nevertheless, the luminous efficiency generally comes out too high by this method, because in each experiment a considerable amount of dark or invisible radiation escapes from the vessel unperceived and unaccounted for.

The *Physikalische Zeitschrift* has recently published a paper by Mr. Von Johannes Russner, on an improvement in the above method of measuring the luminous efficiency of incandescent lamps, an abstract of which appears in the Digest. The improvement consists essentially in using, instead of water, a transparent solution of ferro-ammonium sulphate in the first experiment, for the reason that a solution of this double salt strongly absorbs dark radiation or ultra-red radiation. In the second experiment he coats the incandescent lamp with tin-foil, so as to make the luminous rays effective in heating the liquid, and also so as to avoid changing from a transparent to an opaque liquid.

The results of the tests reported in the paper are given for lamps with filaments of carbon, tantalum, osmium and osram. With a 19-hefner carbon lamp taking 57.5 watts or burning at a specific consumption of 3 watts per horizontal hefner, the luminous power was ⅓ watt, or the luminous efficiency a little over half of one per cent (0.58 per cent). With a tantalum lamp glowing at a specific consumption of 1.31 watt per hefner, the luminous efficiency came out 2.2 per cent. With an osmium lamp at a specific consumption of 1.52 watt per hefner, the luminous efficiency was 2.3 per cent. With an osram lamp at a specific consumption of 1.35 watt per hefner, the luminous efficiency came out 2.46 per cent.

It would seem likely that considerable error may attach to this method, even as improved in the manner described in the article. In the first place, some light is sure to be absorbed by the glass and water in the first experiment, and in the second place allowance should be made for the thermal capacity of the tin-foil cover on the lamp. It is also possible for an error to creep into the results by loss of heat during the stirring process. These errors would probably tend to make the luminous efficiencies come out too low. By repeating the experiments in a variety of different ways, they should be capable of leading to reliable results. It is generally believed, however, that under normal conditions of lighting the luminous efficiency of an osmium or tantalum lamp is about 5 per cent, and that of a tungsten lamp about 8 per cent. The statement of luminous efficiency is, however, meaningless unless the specific consumption of the lamp is given at the same time, because when burning at a dull red, or with large specific consumption, any incandescent lamp has a much lower luminous efficiency than when burning at a dazzling white, or at a high temperature. Angström's equivalent of a purely luminous hefner-meter, or the power required to illumine a normal square centimeter of surface with the horizontal intensity of one hefner at a distance of a meter, is 8.1 ergs per second. The corresponding power for the average of the lamps tested in the above mentioned paper was 2.57 ergs per second, but with a color of light much brighter than that of the hefner flame.

Measurement of Horizontal Candle Power.

The important paper by Uppenborn, which we abstract in the Digest, is the most comprehensive recent discussion of glow lamp photometry. Directed particularly to the determination of mean horizontal intensity, it touches immediately the present line of commercial measurements. In a general way the mean horizontal candle-power is a relatively easy thing to measure, and the precision attainable by simple means is certainly very satisfactory. Yet, as Prof. Uppenborn plainly shows, there is much to be said regarding a choice of methods. Of the various schemes which have been tried, the direct measurement at various angles lacks nothing in precision, but is on account of its slowness quite out of the running for everyday commercial use, and must be laid aside at once save for laboratory work, in which it may serve as a sort of court of last resort. This done there remain three types of measurement which have claims for consideration. These are the integrating methods with fixed mirrors, of which that worked up by Matthews is the best known in this country; the lamp rotating method, which is the one in common use here, and the rotating mirror method, of which several forms have been employed, notably one used in the Reichsanstalt. Many slight modifications of procedure have been introduced by various experimenters, but the broad questions which must be answered are these: First, is it advisable to rotate the lamps rather than to use integrating mirrors; and second, does the lamp rotation method give results sufficiently good for commercial use?

Prof. Uppenborn does not put the matter baldly in this shape, but he has directed his energies to providing the data for just these inquiries, and it is our own fault if we fail to make use of them. Without going into details of his work, the results obtained with rotating lamps of various kinds worked at various speeds of rotation are quite sufficient to show that in point of real precision the rotation method is to be condemned as compared with any of the others. The deformation of the filament under rotation fast enough to eliminate flicker is sufficient to change the distribution from normal quite far enough to introduce errors large compared with the experimental errors in photometric balance. These are none too small, as everyone experienced in photometry knows, to his cost. In comparing closely similar lamps and using a standard lamp in rotation and of similar type, of course more coherent results can be obtained. A method, however, for commercial photometry should be free from this sort of uncertainty. It is another one of the many cases in which consistency in results is no assurance of precision. That speed of rotation makes a very noticeable difference in the results obtained from some lamps is a familiar fact, and while fair comparisons can be made at the same speed and by the same person unless that speed is high enough to completely suppress the flicker, there is little certainly that two observers, especially when not working in conjunction, will get really comparable results. There are, besides, in the rotation methods numerous chances for errors in voltage which, while they may be obviated, detract from the simplicity of the operations. More than this, the magnitude of the errors found by Uppenborn leads one to incline to the opinion that, scientific precision aside, the rotation method unless applied with great discretion and close observance of a fixed routine, is hardly satisfactory for commercial measurements.

It must be said in its favor, however, that it generally errs by giving results in rotation too small rather than too large. If this be borne in mind and the lamps compared have filaments affected in similar degree by rotational distortion part of the error can be eliminated. The residual errors, however, are by no means negligible. Perhaps they might be tolerated under the conditions of commercial sampling with no particular harm, were it not for the fact that the new metallic filament lamps which will soon be dominant in incandescent lighting, furnish a cogent reason for laying aside the rotation method once for all; for thus far all the lamps of this class have filaments so soft when at their working temperature that they cannot safely be rotated and must be burned tip downward to keep the filament from collapsing from its own weight. Even the tantalum lamp, which can be burned in any position, cannot be rotated without some risk. A new problem in photometry is, therefore, arising from which all the ordinary methods are excluded by the fundamental conditions. The incandescent lamp must be tested photometrically while fixed vertically with the socket upwards. To meet this requirement without resorting to the laborious point

by point plan will require considerable rearrangement of the usual apparatus. Some of the integrating mirror methods, all of which give fair precision, can be adapted to the work. We hope, however, that the result will be the general use of the mean spherical rating, which can now by the aid of the sphere photometer be very easily determined with a high degree of consistency and a good degree of precision. The mean horizontal rating has never been a satisfactory one and signifies less to-day than ever before. The sooner it is finally dropped the better, and with it will go all contentions about the relative badness of the methods of obtaining it. We think the results obtained by Prof. Uppenborn are a good argument for hastening the change to a more scientific basis.

THE INCANDESCENT LAMP SITUATION.

Never before has the electric lighting industry witnessed such a scarcity in the incandescent lamp supply. The general prosperity of the country, together with the results of aggressive new business campaigns being carried on by many progressive central station companies, has pushed the demand for incandescent lamps up to a point where it is a source of dismay to the central station companies and lamp users, and the restriction of the independent lamp manufacturing industry has prevented a rapid adjustment to the new conditions. The spectacle of one of the largest central station companies in the country being entirely out of a certain standard size of lamps and being dangerously near complete exhaustion of its supply of other sizes is simply an indication of the general condition of the lamp business the country over. Fortunate and wise is the central station company which operates its circuits at a voltage a little off from the common voltages. Such a company has comparatively little difficulty in getting lamps when others are having much trouble. The present shortage will serve to bring home to any of the smaller companies the desirability of changing to an odd voltage. The "decreasing rate of increase" in the incandescent lamp output does not seem to be troubling manufacturers much at present. Another thing which has complicated the situation from the manufacturer's standpoint is that the new high-efficiency carbon filament lamp requires at present more factory room to produce a given output, and getting ready to manufacture these high-efficiency lamps naturally interferes with the business of turning out the old-fashioned lamps.

THE EFFECT OF ELECTRICITY ON THE FREQUENCY OF RAILROAD ACCIDENTS.

The recent unhappy accident to a train of four cars driven by two electric locomotives on the New York Central Railroad, near the Bronx, in which the cars were derailed, overturned and dragged, with considerable loss of life and injury among the passengers, raises the question as to what bearing electricity as a motive power may have upon the safety of passenger railroad traffic. The frequency of serious railroad accidents is increasing, and attracts considerable attention, particularly abroad, where an exaggerated idea occasionally prevails that the safe arrival of a passenger to his home after a long railroad journey in the United States is a direct manifestation and interposition of Providence. According to the statistics of the Interstate Commerce Commission, the number of passenger trips in 1895 was 507,400,000, or 7.2 trips per head of United States population per annum; while the total number of passenger casualties was 2,545, or approximately one casualty per 200,000 trips in that year. In 1905, a decade later, the corresponding statistical report showed 738,800,000 passenger trips, or about 8.3 trips per head; and 10,994 total passenger casualties for the year, or one casualty per 67,000 trips. This means that passenger accidents in the United States have become, in ten years, 4.3 times more numerous actually, and 3 times more numerous relatively, to the number of passengers carried. The reason for this distinct diminution in the safety of railroad traveling is mainly because the railroads have become more congested. In the same decade, the total United States railroad mileage increased 20 per cent, while the total passenger mileage increased about 75 per cent, and the total ton-mileage of freight has increased about 100 per cent, during the same time. The number of locomotives and of cars also increased about 40 per cent, so that the work demanded from every mile of railroad has on the average increased about 60 per cent, and the work demanded from every locomotive and car about 40 per cent. The whole system is worked half as hard again as it was ten years ago. Moreover, if railroad management in other parts of the United States is comparable with that of the terminal lines at New York, the present railroad personnel, trained under the former uncongested conditions, is evidently unequal to the demands now made upon them, which call aloud for a change of men and methods.

The increasing use of the automatic block system, in which electricity takes so prominent a share, has tended materially to reduce the danger of collisions between trains on the same track. The use of electric locomotives should certainly have the effect of reducing, rather than increasing, the danger of accidents, if the schedule speed is not increased; because not only does the uniform driving and constancy of torque at the driving shafts promote the longevity of the track, but the fact that power can be shut off by the power house, at the order of the train despatcher, also contributes to the safety of electric propulsion. A remarkable fact connected with railroad accidents is that only about 5 per cent of the casualties to passengers are recorded as deaths. The injuries average 95 per cent. A similar, although not the same percentage of fatality, attends accidents to employees. That is to say, there are many injured for each one that is killed. When, however, the accidents to other persons are considered, or accidents to bystanders, crossers and trespassers, the ratio of fatality is very different and amounts to 42 per cent, so that the recorded number of "other persons" killed is nearly as large as of the injured. From this we see that the way of the transgressor is hard. He is very apt to get killed. This is perhaps due to the rough reminder that a locomotive gives as an advertising agent to a man, that if he is going to be on the track it is much safer to be on board the train. With the introduction of electric locomotives on steam roads, we must expect a certain number of casualties due to the change in the mode of operation. Any such change must produce a certain amount of disturbance in a highly organized system, but in the long run, electric propulsion is sure to prove safer than steam propulsion, both for technical reasons and from the higher and more modern order of personnel that it will introduce into the railroad field. One cannot imagine an electric railway system so utterly incompetent with respect to management as, for example, the New York section of the Erie Railroad.

Public Utilities in New York State.

The new Page-Merritt bill introduced under the auspices of Governor Hughes in the New York Legislature abolishes the existing Railroad Commission, the Gas and Electricity Commission, the Inspector of Gas Meters and the Rapid Transit Commission, and confers all their powers upon two public service commissions. It creates two public service districts, with a commission composed of five members for each district, appointed by the Governor.

The first district comprises the Counties of New York, Kings, Queens and Richmond and the second district includes all the other counties of the State. Each commissioner is to receive $10,000, and each commission is to appoint a counsel at $10,000 and a secretary at $6,000. The salaries and expenses of the commission of the first district are provided for in the same manner as the expenses of the present Rapid Transit Commission, and the salaries and expenses of the commission of the second district are made a charge upon the State. The term of office of one commissioner in each district is fixed to expire on February 1, 1909, and the term of office of one commissioner in each district expires annually thereafter. Successors are to be appointed for a full term of five years.

The jurisdiction of the commission in the first district extends to all railroads, street railroads and common carriers operating exclusively within that district; to street railroads any portion of which is within the district, except as to construction and local facilities and transportation outside the district; to the construction and local facilities and transportation of railroads within the district; to the manufacture, sale and distribution of gas and electricity within the district, and in addition the commission is vested with all powers heretofore conferred upon the Board of Rapid Transit.

All jurisdiction not given to the commission of the first district is vested in the commission of the second district, including the regulation and control of all transportation on all roads other than street railroads from one district to another.

To the commission is given power to subpœna witnesses and administer oaths. No person is excused from testifying before the commission, but having testified is immune from prosecution for any penalty or forfeiture concerning any act as to which he testifies, but this immunity does not extend to any corporation.

The bill prescribes the duties of transportation companies, including railroads, street railroads, express companies, car companies, sleeping car companies, freight companies, freight line companies, and pipe line companies, and of gas and electric companies; and gives to the commissions power to regulate the operations of such companies. It provides for adequate sidetrack and switch connections and equitable distribution of cars, and requires the filing with the commission and publication of all tariffs, schedules, joint tariff rates and verified copies of all contracts or agreements between common carriers. It prohibits all unjust discrimination by whatever device, all unreasonable preferences, all false billing by carrier or by shipper and all discrimination or preferential treatment in any respect whatever. Free passes are prohibited save in certain excepted cases.

The bill further provides that the franchise of a public service corporation shall not be assigned, transferred or leased without the approval of the commission having jurisdiction. It forbids a railroad or street railroad corporation, domestic or foreign, to purchase or acquire, take or hold, any of the capital stock of any other similar corporation, unless authorized by the commission, and a similar provision is made as to gas and electric corporations. It further forbids the transfer to any stock corporation except as collateral security only of more than 10 per cent of the total capital stock of any railroad, street railroad, gas or electric corporation, but this does not prevent the holding of stock heretofore lawfully acquired.

The commission is also authorized to approve or disapprove the issue of stocks and bonds of a public service corporation, but is forbidden to authorize the capitalization of franchises, except to the extent that the corporation has actually paid for such franchises to the State or municipality, not including an annual tax charge. It is also forbidden to authorize capitalization, upon the merger of two public service corporations, beyond the amount of the capital stock of the two so merged, or to capitalize any contract for consolidation or lease.

Harriman on Electric Traction.

Mr. E. H. Harriman, the railroad consolidator, who has been on the defensive since his recent investigation by the Interstate Commerce Commission, has given a most interesting interview to the New York *Times*, discussing the railway situation and pointing out many of the economic and technical problems with which managers of the great systems are confronted. He expressed the belief that a 6-ft. gauge would have been of great help in helping the road handle modern traffic, and admitted that there was a limit in length of the firebox beyond which it is impossible to fire an engine.

"So there you are. If we increase our car capacity we increase the unproductive dead weight that is to be drawn disproportionately to the increase of the load, and in so doing we are making demands upon tractive power that has already reached the limit of its development under present conditions. The obvious relief then would be by widening the gauge to 6 ft., and I am not sure that the railroads will not come to that in the end.

"If the country after the civil war had adopted the 6-ft. gauge that some of the railroads in the South then employed, or even a 5-ft. gauge, we would be in much better shape to-day, for we could increase the height and breadth of our locomotives to get greater tractive power per engine, and could increase the capacity of our cars without disproportionately increasing the dead weight that has to be drawn in moving a given trainload.

"But perhaps it is chimerical to think now of rebuilding the railroads of the entire country and of replacing the entire railroad equipment. If so, what is the next best thing?

"Obviously electricity. And I believe that the railroads will have to come to that, not only for the purpose of getting a larger unit of motive power and of distributing it over the trainload, but on account of the fuel proposition. That brings up another phase of the existing conditions. We have to use up fuel to carry our fuel, and there are certain limitations along this line, just as much as there are in the matter of car capacity or of motive power, particularly when you consider the distribution of the coal producing regions with respect to the major avenues of traffic.

"The great saving resulting from the use of electricity is apparent, quite aside from the matter of increasing the tractive power and the trainload, but there is this additional consideration, that when you are operating by electricity you are not losing money when you stop your train. That must not be lost sight of. The train makes money when it is going somewhere, when it is carrying something that somebody wants. When it stops it ceases to make money and becomes a losing proposition because it goes right on burning up coal without doing any work. Your electric train when it stops isn't using up any power, and the only fuel waste is that incidental to the maintenance of the system.

"Now I have gone into these things in detail to show you, first that the railroads in handling the increased volume of traffic under present conditions, or anything approximating them, must do it at an ever increasing ratio of expense that will tend some day to become prohibitive if present rates are to be maintained or fair returns realized for their shareholders, and, second, that the only relief which can be obtained through economies of physical operation must come through the outlay of enormous amounts of money such as would be involved in a general electrification or a change in gauge."

Shearing of Spikes by Steam and Electric Locomotives.

On account of the serious accident which befell an electrically propelled train on a curve near Woodlawn Bridge on the New York Central Railroad, February 16, much discussion has arisen concerning the probable cause for the accident, and the part contributed by the electric locomotives in the derailment. Some studies made subsequent to the accident by the engineers of the General Electric Company, the American Locomotive Company and the railroad company have indicated, that the electric locomotive up to 80 miles an hour imposes less maximum strain on the track than the standard Atlantic type of steam locomotive used by the New York Central Company. An abstract of this analysis is given below:

Three fundamental forces were considered, as follows: (1) Component of slipping in the direction of the radius, due to curvature; (2) component of slipping in the direction of the tangent of track, due to unequal rail lengths inside and outside; (3) net effect of centrifugal force (super-elevation of outer rail considered).

The calculations based on the conditions existing at the time of the above-mentioned accident are recorded in the accompanying table, which shows the comparative shear on spikes at leading truck wheel and at driver wheels for a New York Central electric locomotive and for a Central Atlantic type steam locomotive on a three-degree curve having a super-elevation of 4.5 in. It will be noted that the pressure of the steam locomotive against the rail is greater than that of the electric locomotive at all corresponding speeds. The resultant shear on the spikes, however, allowing for the friction of the rail on the tie plates, is less with the steam locomotive than with the electric up to about 80 m.p.h., where the shear on the spikes due to the outer front driver is practically the same for both.

Miles Per Hour.	Shear on Spikes by Leading. Truck Wheel.	Rail Thrust Leading Driver.	Rail Thrust Leading Driver, 2nd Driver Against Rail.	Friction Between Rail and Tie Plate Leading Driver.	Shear on Spikes by Leading Driver.
		ELECTRIC LOCOMOTIVE:			
40	2410	4740	3860	4180	560
50	2570	7409	4120	4360	3040
60	2780	10470	4480	4650	5820
70	3020	14130	7460	5000	9130
80	3300	18360	11000	5360	13000
		STEAM LOCOMOTIVE (ATLANTIC):			
40	4630	6120	6260	6280	....
50	4740	7450	6220	6720	650
60	4890	11230	5460	8170	2710
70	4840	15390	7570	9420	5320
80	4770	21160	13020	11250	9920

Figures underlined represent maximum shear by either leading truck wheel or driver, under worst conditions.

The difference between the pressure against the rail and the shear on the spikes is affected so far as the drivers are concerned by the height of the center of gravity, which, under the influence of centrifugal force, increases the vertical pressure on the outer rail. The greater effect of the higher center of gravity of the steam locomotive disappears, however, at the higher speeds by reason of the increasing preponderance of the horizontal force due to centrifugal action. At about 90 m.p.h. the shear on the spikes for the steam locomotive would not only be in excess of that of the electric locomotive, but at this speed the steam locomotive would be in danger of overturning.

It will be observed that for a speed of 60 m.p.h. the maximum shear on the outer spikes of the outside rail under the most unfavorable conditions is for the electric locomotive 5,820 lb., as compared with 4,890 lb. for the steam locomotive. The ultimate shearing resistance of the standard spikes used on the curve in question ranges from 14,440 lb. to 17,060 lb. Assuming a factor of safety of 4, the permissible shear per spike is from 3,810 lb. to 4,265. Considering that the force is resisted by two adjacent spikes, the actual factor of safety would be approximately 6.

It would appear from the above calculations that the electric locomotive imposes slightly greater unbalanced stresses than the steam locomotive on the three-degree curve properly maintained, with super-elevation of 4½ in., but that the shearing force on spikes, one on the outside of the outer rail in each tie, with tie plates, is far within the limits of safety for speeds in excess of the so-called "equilibrium speed" of about 46½ m.p.h. to which the super-elevation of 4½ in. corresponds.

Lighting Rates in San Francisco.

The Board of Supervisors of San Francisco, after an investigation, has fixed the rates for lighting by gas and electricity for the new fiscal year. The gas rate was fixed at 85 cents per 1,000 cu. ft. as the maximum, and the remainder of the existing light rates were also readopted with a single change. This provides that where electricity is being sold by meter measurement the minimum charge shall be $1 a month instead of $1.50. The new schedule is as follows: Gas per 1,000 cu. ft., 85 cents; street gas lamps, single, 8 7/10 cents per night; street cluster lamps, 15 cents per night; electricity per 1,000 kw-hour, 9 cents; electric arc lamps burning 24 hours, $5 a week; electric arc lamps burning from sunrise to sunset, $3 a week; electric arc lamps burning from sunset to sunrise, $2.25 a week.

During the investigation John A. Britton, president of the San Francisco Gas & Electric Company, testified that the ordinary expenses for the maintenance of the gas plant during 1906 were $87,163.57, and of the electric plant $157,950.80. The extraordinary expenses caused by the destruction in part of the two plants were respectively $276,018.10 and $570,326.99. Continuing, Mr. Britton said:

"Eliminating the extraordinary expenses from the cost items would reduce the actual cost of producing the gas to $1,926,963 for 1906, or about 91 cents per 1,000 cu. ft. The company is now using oil almost entirely for the manufacture of gas, but little or no saving will be effected thereby. We are now paying 55 cents a barrel for oil, but after the contract has expired, on May 31 next, we will probably have to pay 90 cents per barrel, which will increase the cost of gas from 12 cents to 15 cents per 1,000 cu. ft. during the next fiscal year, and also raise the cost of electricity. Even at the increased price of oil its use would be cheaper than coal, which has also increased in price. The cost of gas in the holder is 39 cents per 1,000 cu. ft., or 8 cents more than last year, due to excessive leakage from broken mains. The cost of repairs to the gas and electric plants was $698,571.95, of which $283,000 was expended on the gas plant. I estimate that we will sell 2,500,000,000 cu. ft. of gas and 50,000,000 kw of electricity during the coming year. While the existing ordinance fixes a maximum rate of 9 cents for electricity, we collected an average of only 4½ cents per kw-hour. The loss to the plant was $4,273,000, of which $1,815,813 represented the loss of 36,663 meters, 955 lamp posts, 1,053 lanterns, two holders at Fifth and Howard Streets, damage to the North Beach plant and the gas mains and $2,457,187 the loss of the electric plant, including the seven stations, poles, overhead and underground wire systems destroyed."

New England Electric Lighting Engineers.

The fifth annual meeting of the Association of Electric Lighting Engineers of New England will be held at the New American House, Boston, on Wednesday, March 20, at 1 o'clock p.m. The following papers or topics will be read and discussed: "Automobiles and Central Station Practice," by D. F. Burritt, of Springfield; "High-Efficiency Units," by Mr. Doane, of the Bryan-Marsh Co.; "Employers' Liability, Its Benefits and Costs," by Mr. Linscott, of the Employers' Liability Assurance Corporation, Ltd.; "Moore Tube System of Lighting," by Prof. H. E. Clifford, Massachusetts Institute of Technology; "Opinions and Attitude of Presidents of Electric Lighting Companies Toward Their New Business Departments"; "Solicitors' Work and Comments," opinions of managers.

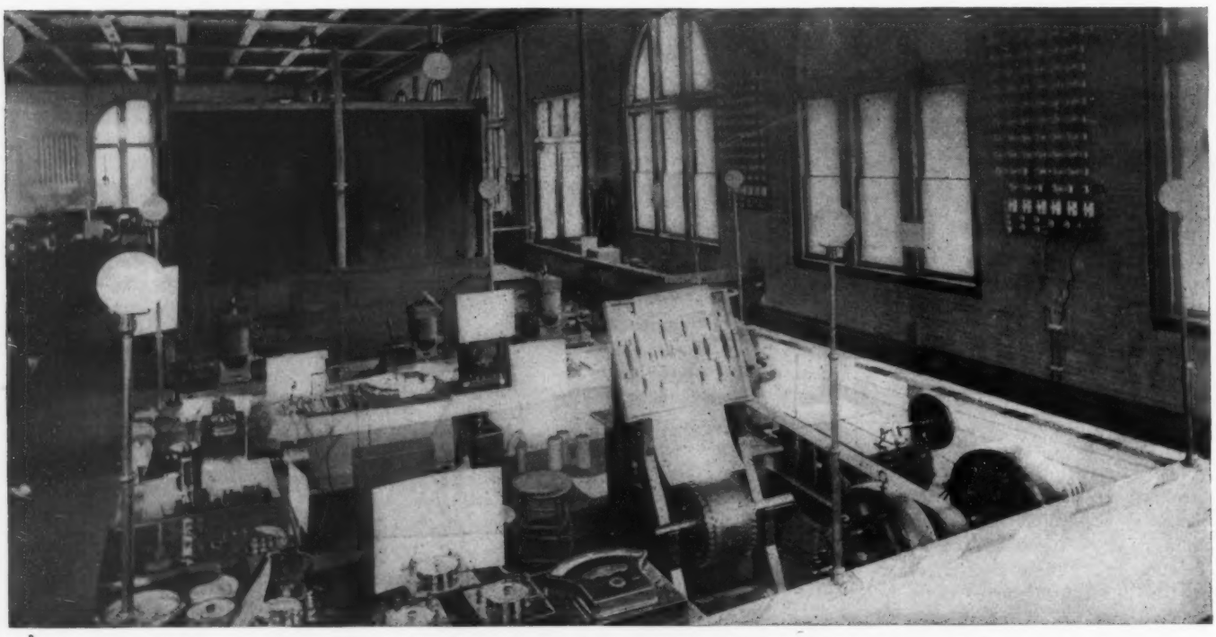
Electrical Show at the University of Illinois.

An enterprising piece of work worthy of favorable mention has been carried out by the electrical engineering students of the University of Illinois at Urbana. This was the Electrical Engineering Electrical Show, held the evenings of March 1 and 2. The combination of instructive exhibits of things of scientific interest with things to catch the popular fancy and the means used to advertise the show proved the assertion we have often made that the technically trained man is equal to almost any emergency, and that he is not necessarily an adept in engineering matters only. The proceeds of the show went to the Robert Fulton memorial monument fund. The entire electrical engineering building was given over to the show for two days. The paid attendance in that time was over 1,600 and each evening the "live conductors" who conducted the show had all they could do to take care of the crowd. It was entirely a student enterprise with of course the advice and co-operation of Prof. Morgan Brooks and the instructors in the department. Every ten minutes each evening demonstrations were given of high-tension phenomena with a 10-kw, 100,000-volt transformer built last year by students in connection with thesis work.

The interurban test car of the University was shown on an adjoining track, this being one of the most complete cars now in existence for obtaining electric railway test data. One room was devoted to the display of the different new electric illuminants such as "Gem" carbon filament, tantalum, Nernst and Cooper Hewitt lamps. There was some excellent simple home-made apparatus for showing the principles of induction and the rotating field and in another place short lectures on fundamental principles with Thordarson apparatus were given. Another room was devoted to the demonstration of high-frequency phenomena. A demonstration of the methods of resuscitation after electric shock was given frequently.

It must not be thought from the foregoing, however, that all the things shown were not of a popular character. The students demonstrated fully their ability to get up popular "stunts" and present them in a popular way. One of these was the charged tub of water, with apples in it for those who would pick them out. Another was the iron eater, who swallowed promptly all the nails thrown at his face. At several telephone exchange boards around the building people were given a chance to learn how it feels to be a telephone operator. The "bucking broncho" was a catchy advertising title for a motor which frequently reversed its rotation without a reverse switch, which puzzled even some technical men.

The *Electrograph*, a paper issued in advance of the show, to advertise it, was very cleverly edited. Only a few of the chief features of the show have been mentioned. It is expected to hold another next year.



Electrical Show, University of Illinois.

Office Illumination.

The general subject of the meeting of the Illuminating Engineering Society, held in New York on March 8, was "The Lighting of Large Office Spaces." Mr. W. J. Clark read a paper describing the lighting of the offices of the Consolidated Gas Company, New York. Mr. Edward A. Norman reported the results of tests showing the relative values of different methods of office illumination, and a paper by Mr. S. B. Burroughs explained the merits of several kinds of lighting now being used in Brooklyn. The lighting of the office building of the Consolidated Gas Company, of Baltimore, was discussed in a paper by Mr. Charles M. Cohn.

Mr. Clark showed that in the Irving Place branch of the Consolidated Gas Company there are used six groups of four gas arcs, each consisting of four mantle burners, hung from iron columns. The lamps afford an illumination of 1.47 candles per square foot of floor space. Although the ceilings and side walls are poor reflectors, the illumination is sufficient to admit of the discarding of all desk lamps. At the Forty-second Street office there are thirty-one gas arcs in use, the illumination being .64 candles per square foot. The ceilings and side walls are white, so that the effect is even more pleasing and satisfactory than at the Irving Place. The author concludes that it would be of great value to everybody concerned if the illuminating engineer could be brought into closer touch with the architect, the builder and the fixture man, and especially with the decorator.

The paper by Mr. Norman showed the results by three different methods of office illumination, and compared the relative efficiencies of the different methods. It also presented results secured by the use of arc lamps of the concentric diffuser type in a draughting room. The tests were conducted at the Harlem office of the New York Edison Company, where cove lighting

and Holophane clusters are used, and at the company's Duane Street office, where diffuser arcs are installed. The Harlem office has a floor area of 1,221 sq. ft., and its volume is 28,388 cu. ft. The ceiling and walls are of light cream color, while the lower walls are in part of dark finish. The cove contains 280 16-cp clear lamps. Six Holophane clusters of a special type, two of which were equipped with 100-watt Gem lamps and four with standard 16-cp lamps, were installed, not so much with the idea of increasing the illumination as to give direction to the light. In order to make a comparison of the cove lighting with one of the most efficient forms of incandescent lighting known, two rows of incandescent lamps, 42 in each row, were strung temporarily along the ceiling, tip downward, equipped with Holophane concentrating reflectors. The tests showed the following results:

	Cove.	Ceiling.	Clusters.
Watts per square foot	7.47	3.41	1.96
Watts per cubic foot	.321	.147	.0842
Candle power per square foot	2.41	1.1	.71
Candle power per cubic foot	.104	.0473	.0304
Average foot candles per watt	.00042	.00131	.00091
Average lux per watt	.0045	.0141	.0098

On the basis of these figures, therefore, considering the ceiling lighting as 100 per cent., the cove lighting would have an efficiency of about 32 per cent, and the cluster lighting an efficiency of about 69 per cent.

While diffused lighting by the cove method is very attractive, and while undoubtedly it possesses the virtue of not offending the eye by a high intrinsic brilliancy at any one point, it is nevertheless trying to a certain extent, due, possibly, to the fact that no matter where the eye rests the same uniform illumination prevails. For instance, when one looks up from a book or paper it is impossible to rest the eye by gazing at any dark portion of the room, due, possibly, to the inability of the eye to focus properly, as distances are very deceptive.

At the Duane Street office the illumination is supplied by 5.8-amp. carbon arc lamps fitted with concentric diffusers with inverted cone alabaster globes, placed 11 ft. above the floor. The room has a floor area of 1,519 sq. ft. and contains 20,506 cu. ft. With a power consumption of 8.01 watts per square foot or .593 watts per cu. ft., the average foot-candles per watt was .00111 and the average lux per watt .0119. The illumination intensity varied from 8.6 to 16.2 foot-candles, the average being 13.5. Notwithstanding the fairly low ceiling and the high illumination, the diffusion is very good and the light is not objectionable. A personal canvass among the men working under the lamps confirmed this opinion.

In his paper on the lighting of office spaces Mr. Burroughs cited examples of illumination to show that in large, open offices the concentric diffuser arc is very efficient and satisfactory where the artistic sense is not considered, and that with this unit no desk lighting is necessary. In partitioned spaces smaller lighting units should be used and placed units can well be utilized with a desk illumination of from two to four foot-candles. In spaces where the lines of the building must be brought out and a soft general illumination is necessary, the incandescent unit is the best to use, as the arc and other large units do not lend themselves to artistic arrangements.

The paper by Mr. Cohn reported excellent results from the use of amber-tinted shades sand-blasted inside for the purpose of overcoming the unpleasant whiteness and glare of the mantle gas burner. It has been found that although the amber-tinted shades absorb from 30 to 35 per cent of the light, they are very desirable and popular.

The discussion was opened by Mr. E. L. Elliott, who remarked that for the lighting of drafting rooms an intensity of 13.5 foot-candles, as discussed in Mr. Norman's paper, is too high. Moreover, a value for the watts per square feet of 8 seems excessive. The fact that the men working under the above-mentioned illumination are pleased with the effect cannot be taken as conclusive proof that the illumination is proper. It is preferable in drafting rooms to use more localized lighting and not so much general illumination. In commenting upon Mr. Cohn's paper, Mr. Elliott stated that attempts had been made at least ten years ago to obtain a suitably tinted glass for use with lamps which did not absorb too much of the light. Amber-colored glass was found to have the proper tint, but the absorption was excessive.

Mr. W. D'A. Ryan called attention to the fact that the inverse square law cannot be applied in the determination of the intensity of illumination when reflectors are used on the lamps. It is, therefore, not applicable to the measurement of the lighting of large interiors. By changing the reflectors on any certain lamp it is possible to change the location of the lamp vertically through a considerable distance without producing any perceptible change in the illumination on any chosen area below the lamp. He showed by diagram that while the cove lighting described by Mr. Norman produces an excellent effect for advertising purposes, for which it was intended, it is somewhat objectionable from the standpoint of illumination. Although the concentric diffusers, in connection with arc lamps are not ornamental, the results from the combinations are entirely satisfactory and their appearance is certainly not objectionable when they are used in drafting rooms.

Mr. J. E. Woodwell stated that the results recorded in Mr. Norman's paper seemed to show that cove lighting is not desuitable for general illumination. When such lighting is properly installed, however, the results are entirely satisfactory. In drafting rooms a high brilliancy is not objectionable, provided the illumination is properly diffused. An intensity of 10 foot-candles is perhaps excessive, while a value of 5 foot-candles is probably more nearly correct. In drafting rooms it is essential to use a large number of lighting units in order that the illumination may be well diffused. The plan suggested in Mr. Cohn's paper with reference to the use of amber-colored glass is a most excellent one.

Mr. A. A. Pope explained that in the case of the Harlem office of the New York Edison Company cove lighting had been used because the ceiling of the room was fairly well arranged for this purpose when an attempt was first made to select the lighting units. In the Duane Street office of the New York Edison Company the brilliancy is high at the present time because many arc lamps were installed initially to insure proper distribution, and subsequently concentric diffusers were added to the lamps, thereby increasing the illumination very greatly. He expressed the opinion that a large demand will arise for amber-colored globes, provided satisfactory ones can be obtained.

Dr. A. H. Elliott discussed the process of manufacture of glass and stated that the amber-colored glass is the cheapest product turned out by the manufacturer. Manufacturers can readily supply any demand for amber-colored glass and they will welcome its use for lamp globes.

Dr. C. H. Sharp drew attention to the fact that when indirect lighting is used the ceiling must be more brilliant than the surface to be illuminated, and therefore the eye is not rested when one looks toward the ceiling. Indirect lighting is therefore quite fatiguing to the eye. It is desirable to have shadows in the room for the purpose of resting the eye.

Mr. E. Y. Porter thought that for office lighting it is preferable to have uniformly distributed illumination and no concentrated light. Such a method can be carried out without increase in the expense. Stores should never be dark, on account of the gloomy effect darkness produces, but should be brilliantly illuminated, so that both the customers and the clerks may be kept in a cheerful mood.

Mr. W. B. Sanford described some tests made with the object of comparing the illumination obtained from arc lamps with that from tantalum lamps. He showed that with arc lamps using 4 watts per square foot of illuminated area the illumination was only fairly satisfactory because the light was not properly diffused, while when tantalum lamps equipped with Holophane reflectors were distributed uniformly around the ceiling the illumination was considerably better diffused, while the consumption was decreased to 1.83 watt per square foot.

Mr. P. S. Millar stated that tests recently conducted upon certain amber glass showed that the absorption is about 14 per cent, and not 30 per cent, as had been assumed by the other speakers.

CURRENT NEWS AND NOTES.

NEW YORK ELECTRICAL SOCIETY.—Mr. C. J. H. Woodbury will present a paper on March 27 before the New York Electrical Society entitled "The Influence of Underwriters' Rules on Electrical Development."

OKLAHOMA CONVENTION.—The Oklahoma Electric Light, Railway & Gas Association is to hold a convention at Oklahoma City, April 22 and 23. This is the first meeting of a newly formed body, in which it is believed the local companies will take considerable interest. Mr. Charles W. Ford, of Oklahoma City, is the secretary.

ARC LIGHTING.—On Wednesday, March 20, Mr. Richard Fleming, of the General Electric Company, will present an illustrated paper on arc lighting before the Electrical Engineering Society of Columbia University in Room 301 of the Engineering Building of the University at 8.15. All interested are cordially invited to attend.

WIRELESS ON TRANSPORTS.—Orders have been received at San Francisco from the War Department for the immediate equipment of the transport service with wireless telegraphy apparatus. This will apply to all ships in the service running between there and the Philippine Islands, and the order will probably become effective by May 1, allowing the transport going out on May 5 to be equipped.

MUNICIPAL OBLIGATIONS.—There is reason to believe that the excessive demands of American municipalities for new funds have had a good deal to do with the scarcity of available capital. The *Financial Chronicle* says that the February aggregate of municipal bond proposals was larger than that of any February since 1892, and, in fact, exceeded any monthly output ever recorded, with two exceptions. The total sales amounted to $37,740,322, not including $2,893,000 temporary loans, or $1,191,123 Canadian securities. It compares with $28,390,000 put out in February, 1906.

NEW YORK SUBWAYS.—The New York Rapid Transit Commission has recently adopted the plan of contract for the proposed new subways line, which are already badly needed to meet the growth of travel. The new routes can be built in sections, and the Interborough Company is permitted to build, the probability being that it will. The Lexington Avenue line will be 13.1 miles in length and will cost $30,000,000 for physical construction. The Seventh-Eighth Avenue line will be 10.3 miles long and will cost $24,385,000. The power plant, rolling stock and general equipment is estimated at about $1,000,000 per mile, making a grand total of between $75,000,000 and $80,000,000 for the new undertakings. It is believed that work will now be pushed actively.

OUR CANADIAN SUBSCRIBERS.—The present postal treaty between the United States and Canada expires on May 7 next. The Canadian Government has before it a proposition to increase the rate of postage on periodicals from the United States to such an extent as to render it necessary for American publishers to raise their subscription prices to Canadian subscribers by from 50 to 100 per cent. If Canadian friends of the Electrical World object to such an increase of prices it will be well for them to make known their objections at once to the Canadian postal authorities. We feel that it is a matter in which they are interested, for the electrical relationships between the two countries are very close and it has always been the aim of the Electrical World to make them closer and more friendly. No real valid reason can exist, we believe, for a discrimination against American technical journals that will make them more costly to the numerous Canadian readers desirous of keeping themselves informed as to development and progress on this side of the border.

MARCH MEETING A. S. M. E.—The American Society of Mechanical Engineers will be addressed on Thursday evening, March 21, in New York City by Mr. John Lieb, Jr., vice-president of the society. The subject will be "Vesuvius and Pompeii," illustrated by lantern slides from original photographs taken by Mr. F. A. Perret, who was in the Vesuvian Observatory during the last eruption, and from photographs taken by Mr. Lieb himself during a visit to Vesuvius and Pompeii shortly after the eruption. A series of lantern slides, showing the state of the mechanical arts in Pompeii has been especially prepared for this lecture. Through the courtesy of Mr. E. Burton Holmes, the well-known "Travelogue" author, a series of original moving pictures of Vesuvius in eruption, and of a flowing stream of lava will be shown by Mr. Oscar B. Depue. The meeting will take place in the spacious auditorium of the Engineering Societies Building at 29 West Thirty-ninth Street. As this is a subject of general interest, members are invited to bring ladies to the meeting. If members who wish to invite friends will address the secretary, invitations will be sent promptly. Persons who are not members of the society and wishing to attend this meeting, will receive tickets of admission by addressing the secretary.

A PARIS STRIKE.—The electricians of the Paris lighting companies went on strike suddenly last Friday, without a word of warning, and left the city practically in darkness, disabling restaurants, theatres, hotels, newspapers, stores and industries of all kinds. The new subway works were flooded by the stoppage of the electric pumps; and the Palace of the Elysee, residence of the President of the French Republic, was also left without light. Candles and oil lamps were resorted to hastily. Concessions were made that enabled the plants to run again on Sunday. The dispute arose from the claim of the strikers to be treated on the same basis as the employes of the small municipal plant operated by the city, with an 8-hour day, holidays, pensions, etc. The companies have been making new contracts with the city, affording an opportunity for this sudden blow. A special dispatch says: "The public is alarmed at the ease with which a few hundred workmen at the instigation of the Confederation of Labor were able to throw the population into confusion, and the newspapers print editorials demanding legislation which will prevent workmen engaged in supplying a public necessity from striking. It is pointed out that the electricians, now that they know their power, may not rest content with present conditions. It is a significant fact that the strike committee is still holding meetings."

ENGINEERING SOCIETIES BUILDING.—A preliminary announcement has been made with regard to the dedication of the Engineering Societies Building, New York City. The formal dedication exercises will take place on the afternoon of Tuesday, April 16, to be followed by a general reception in the evening. On Wednesday afternoon what are called "Founders' Day" exercises will take place, with addresses by representatives of the three founder societies, the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Mining Engineers. These will be accompanied by greetings from sister societies and institutions, presentations of medals, etc. The evening is left free for private social entertainments. On Thursday there will be professional sessions of founder societies. In the afternoon, before the American Institute of Mining Engineers, Mr. H. T. Hildage will present an important paper descriptive of the excavation and tunnel work now being carried on by the Pennsylvania Railroad. In the evening another important paper or address will be presented before the American Society of Mechanical Engineers by Brig.-Gen. W. Crozier, U.S.A., on "The Ordnance Department as an Engineering Organization." On Friday afternoon the Mining Engineers will have another session, followed by an informal smoker in the evening. All these sessions are open in common to members of the three founder societies. Details will soon be available of the dedication exercises on April 16, for which elaborate preparations are now being made.

SOUTHERN ENTERPRISES for the year 1906 included 238 electric light and power companies and 280 telephone companies. Gas works numbered 52.

ELECTRICITY IN JAPAN.—A list of Japanese enterprises formally organized and projected since July, 1905, compiled by United States Consul-General H. B. Miller, of Yokohama, shows that the new capital of companies building electric railways amounts to $55,825,000, and the investment in other electrical enterprises to $49,711,500, of which $27,375,000 is employed in developing Japanese water powers.

TAXING ELECTRIC SIGNS.—A bill has been introduced in the Legislature at Albany which provides for an annual tax of 12 cents a square foot on all signs over 32 ft. square. Certain signs, such as signs on hotels which give the name of the hotel, signs composed wholly of electric lights, and certain other business signs of modest size are exempted. Surfaces used for sign purposes are to be taxed 8 cents per square foot.

NOT FOR COUNCIL BLUFFS.—At Council Bluffs, Iowa, on March 4, the City Council turned down the plan for the city to own the city water works and voted to grant a new franchise to the water company. The action was taken after a petition, signed by almost every business man in the city, had been presented to the council asking that the municipal proposition be killed.

A GERMAN BULLETIN.—One of the handsomest bulletins in the field of electric light and power is that issued by the Berlin Elektricitäts Werke. It is of standard size with its American compeers and is issued monthly, in 16-page form, with free use of colors in the cuts and an artistic arrangemnt of the type. The matter is well selected and interesting. Each month a calendar is given on the last page. The bound volume for 1906 that has reached us recently bound in leather is a welcome addition to the technical library.

AN IDEAL COMMISSIONER.—Last week it was made known at the meeting of the New York Board of Aldermen that the Municipal Ownership League forces had suggested David Mann as a commissioner to aid in the revision of the Building Code. Mann, who is a stoneworker, acted as go-between, according to his own admission, when $6,000 was paid over to Alderman Clifford for the alleged purpose of influencing the vote of the Municipal Ownership League Aldermen in favor of Rufus B. Cowing for Recorder. The appointment was confirmed.

LAWS ON LIGHTING.—The Board of Gas & Electric Light Commissioners of Massachusetts have compiled and issued in pamphlet form the general laws of the State relating to the manufacture and sale of gas and electricity by persons and corporations, both private and municipal. This is inclusive of the special laws with respect to the Boston Consolidated Gas Company. Over 150 closely printed pages are required for this body of legislation, due partly to the fact, however, that sections that have been repealed are given in italics, with the new or substitute clauses in brackets. There is an index of the contents. As defining the scope and jurisdiction conferred on such a commission the book is one of unusual interest.

TELEGRAPHIC SECRECY.—At a recent conference in Peking between the Ministers of the Waiwupu and Yuchuanpu (Foreign Office and Posts and Communications) it was decided to inflict the penalty of summary decapitation upon any telegraph employe who may in future be found guilty of revealing the contents of secret official telegrams to outsiders. For the culprit revealing ordinary official telegrams to outsiders the penalty will be ten years' imprisonment. Any one knowing that an official telegram had been revealed to outsiders and failing to report the same to the proper authorities will be sentenced to five years' imprisonment. These new regulations have been officially notified to the officials of the Chinese Telegraph Administration throughout the country.

AN ABOMINATION.—At the opening of the Motor Show on March 7, the Lord Mayor of London said: "I believe individual enterprise is the thing that will make this country great, and that it will altogether knock out municipal enterprise. I firmly believe that municipal enterprise is a curse and an abomination. I don't believe it is good for any State or country that even tramcars should be run by municipal enterprise. I believe as time goes on the motor industry will produce something which will make tramcars of the present day scrap iron and stop their operation by municipalities. I am told there was an election in London on Saturday. I believe this election was gained not at all, or very slightly, on political lines. It was a protest of the electors against municipal trading."

A. I. E. E. AT SCHENECTADY.—The March programme of lectures before the Schenectady Branch, American Institute of Electrical Engineers, has been issued. On Thursday, March 14, Mr. S. D. Sprong, of the New York Edison Company, is to give a lecture on the system which lights New York City. The subject for March 21 is "Arc Lighting" and will consist of an address by Mr. Richard Fleming, of the General Electric Company's Lynn works. Mr. C. W. Larson, of the Power & Mining Department, General Electric Company, will talk on "Mine Locomotives and Mining" on Thursday, March 28. The stereopticon will be largely used to illustrate these lectures, which will increase the interest aroused by the attractiveness of the subjects and the reputation of the speakers.

INDUSTRIAL EDUCATION.—The National Society for the Promotion of Industrial Education was organized in November, 1906, in New York City, when a constitution was adopted and officers were elected, Dr. H. S. Pritchett being made president. Mr. C. P. Richards, of Columbia University, is secretary and has just issued a general appeal for support and membership. All persons interested in the subject of industrial education are eligible to membership, and there are four classes: honorary, exempt from dues; life members, paying $250 or more; sustaining members, who pay annual dues of $25, and members who pay $2 annually. In addition to the president, vice-president, secretary and treasurer, the officers comprise a board of 27 managers, nine elected at each annual meeting. The annual meeting is to be held each November, and other meetings as decided by the executive committee.

CORNELL UNIVERSITY BRANCH A. I. E. E.—The regular March meeting of the branch was held in Franklin Hall on Friday, March 8. The secretary presided in the absence of the chairman. The feature of the evening was an original paper presented by Mr. J. S. Codman, of Boston, Mass., rates specialist of the General Electric Company. Mr. Codman's paper was a masterly analysis of the principles underlying equitable rates. The attendance at the meeting was 70. After the formal part of the exercises an opportunity was given for the members to meet Mr. Codman, and a number took advantage of the opportunity for further discussion of the topic. The paper was fully discussed by local members and a number of difficult points were thus explained and illustrated. At the preceding meeting the executive committee was increased by the addition of Mr. R. L. Stone, an undergraduate associate of the Institute, who will represent the students' interests on the committee.

MUNICIPAL OWNERSHIP INQUIRY.—Mr. E. A. Moffett, secretary of the committee on public ownership and operation of the National Civic Federation, reports that the "Committee of Twenty-one" has concluded its investigation of American cities by visiting Cleveland, Detroit and Philadelphia. Sub-committees and individual members are now at work whipping into shape for final and decisive consideration the information obtained here and abroad. The amount of data gathered has proved much more voluminous than was anticipated; and the committee has been considerably hampered through sickness. Two members of the "Committee of Four," whose special task it is to weigh all the gathered facts and report upon the same to the Committee of Twenty-one, Messrs. Bemis and Parsons, have been seriously ill. The former has recovered, but as the latter has not this sub-committee has been reorganized. It is expected confidently that the report to the commission will be ready in April.

JERSEY CORPORATIONS.—According to the report of Winton C. Garrison, chief of the Bureau of Statistics, 483 industries, with a capital of $72,407,500, either organized and commenced doing business in New Jersey last year, or moved to that State from other locations. The report says: "The principal industries represented are automobiles and other motor vehicles, fifteen companies, capital $2,011,000; artificial building blocks, twenty-two companies, capital $3,110,000; Portland cement, three companies, capital $550,000; brick and terra cotta, thirteen companies, capital $1,085,000; builders' hardware, two companies, capital $135,000; chemicals, eight companies, capital $975,000; doors, sashes and blinds, seven companies, capital $660,000; steam engines, electric motors and other machinery, thirty-five companies, capital $4,432,500; jewelry, thirteen companies, capital $1,040,000; rubber goods, six companies, capital $3,332,000, and silk and other textile goods, twenty-four companies, capital $2,535,000." Other industries which show large prospective increases are the production of iron and steel, to embark in which five new companies, with authorized capital aggregating $3,850,000, were organized, and the manufacture of electrical machinery and appliances of various kinds, to carry on which twelve companies, capitalized at $2,625,000, were formed.

ELECTRICITY FOR CASCADE TUNNEL.—The Great Northern Railway has completed plans for the substitution of electricity for steam for the operation of trains through the Cascade tunnel, one of the longest railroad tunnels in this country. The electrical power will be obtained about 35 miles from the tunnel, where large water power can be developed. By the construction of about two and one-half miles of waterway it will be possible to obtain a head of 140 ft. Under the direction of President Hill the electric plant will be constructed in two sections, each one independent of the other, so that in case of a failure of a portion of the plant the rest can be used. The Great Northern tunnel through the Cascade Mountains is built through solid granite in which scarcely a crevice can be found in the whole length of the tunnel. From portal to portal the tunnel is 14,400 ft. long, or between 2½ and 3 miles. The grade is about 1.7 per cent., one end being 240 ft. higher than the other. It is possible for trains running down grade through the tunnel to run through by gravity. In the other direction there is of course a long pull up grade, which requires considerable power for the heavy freight trains. When electric power has been installed in the tunnel locomotives will still run through it as now, but not under their own steam. The whole train, locomotive and all, will be pushed through the tunnel by large electric motors.

GROUNDING NEUTRALS AT COLUMBUS, O.—The practice of the Columbus Railway & Light Company in securing good grounds for the secondary circuits of transformers in order to safeguard its customers and apparatus is to connect to the street railway tracks whenever possible. Track grounds are so much preferred to any other kind that a ground wire will be run half a block to secure a track ground if it is necessary. Where tracks are not near enough for this, plates are placed in the pole-holders during construction. The company operates a four-wire primary distributing system with 2,300 volts between the outer legs and neutral and 4,000 volts between the outer legs. The neutral is grounded. The grounded neutral wire of the high-tension system is also the grounded neutral of the low-tension system. Tests made on long lines for bad effects on the secondary from induction upon breaking a high-tension circuit have been made, but the effects were practically nil. The high-tension neutral is connected to ground at every transformer and lightning arrester. The company did not lose a transformer from lightning for five years. The lightning arresters used were partly Garton-Daniels and partly General Electric—the latter being made over and equipped with larger iron boxes 2½ in. deeper and 1 in. wider than those in which they were originally placed. The manufacturer's box cover was, however, used on the boxes.

DINNER OF HARVARD ENGINEERING SOCIETY.—The ninth annual dinner of the Harvard Engineering Society was held on Saturday evening, March 2, in the Harvard Union. There were 144 present at the dinner, of which number 47 were graduates, representing classes from 1855 to the present day. Prof. L. N. Hollis, chairman of the Division of Engineering, presided, and introduced the following speakers of the evening: Mr. G. S. Rice, '70, chief engineer Rapid Transit Railroad Commission, New York; Mr. J. R. Worcester, '82, consulting engineer, Boston; Mr. Franklin Remington, '87, president Foundation Company, New York; Mr. F. L. Gilman, '95, chief engineer Western Electric Company, New York; Mr. J. A. Moyer, '99, chief of the computing department General Electric Company, Lynn; Mr. H. M. Hale, '04, assistant engineer Rapid Transit Railroad Commission, New York. Before adjourning a resolution was unanimously adopted to appoint a committee to report not later than commencement, 1907, on means for effecting a closer affiliation among Harvard men interested in engineering. It is proposed to establish a Harvard Engineering Society in New York City, and possibly in other large engineering centers where the number of Harvard graduates interested in engineering may warrant. The following committee was appointed: Prof. L. J. Johnson, chairman; Messrs. G. S. Rice, F. W. Dean, J. E. Vaughan, F. L. Gilman, H. M. Hale, H. P. Forté.

HOLYOKE ELECTRIC LIGHTING.—The annual report of the Holyoke (Mass.) Gas & Electric Department says: "The electric station is fast being got into shape to handle comfortably the constantly increasing business that is crowding upon it. During the year there has been installed one 1,000-kw turbo-generator. Three new boilers have been contracted for. Upon their installation the station will have a rated steam capacity in its two steam turbines and its two reciprocating engines of 3,000 hp, and a possible maximum capacity of 4,000 hp. This is in addition to the 1,000 hp in water power; but practically is the rated capacity of the station, owing to the fact of there not being an unfailing supply of water power attached to it. The greatest demand upon the station the past year has been about 2,100 hp. There have been added to the street lines 21 miles of wire, 41 transformers have been set and 237 meters have been added. There has been a gain of 193 in the number of customers using electricity, or 37 per cent increase. Owing to the good financial showing of the electric station it is found practicable to reduce the price of street arc lights from $80 to $60 per light per year, making a reduction in the amount the street department pays this department for street lights of over $10,000 per year. It has been the custom of this department to furnish the first installation of incandescent lamps and to charge for renewals. Commencing as soon after January 1, 1907, as the lamps can be procured, it will also furnish free renewals. In addition it proposes to furnish lamps of a different rating. In place of a 16-cp lamp consuming 56 watts, it will furnish one that will consume 50 watts."

The New Central Station of the Haverhill Electric Company.

WITHIN the last year or two some important improvements have been carried out at the power plant of the Haverhill, Mass., Electric Company, with the general object of securing a more efficient organization of equipment and a larger flexibility of operation than was possible in the old plant. Some of these improvements were touched upon briefly in the series of articles in Central Station Economics in Massachusetts, published in the ELECTRICAL WORLD in January, 1906, but at that time no illustrations of the station were in hand, and neither was the plant taken up in detail. The installation is now well reorganized and is giving excellent service on the basis of its new equipment. The present total connected load includes 2,000 hp in motors, 541 alternating-current multiple arcs, 203 Brush arcs for street service and 25,000 16-cp incandescent lamp equivalents. The maximum peak load in the winter of 1906-7 was 1,650 kw.

The power plant of the Haverhill company is located on Water Street on the east bank of the Merrimack River, about 2,000 ft. from the Haverhill City Hall, which may be regarded as the center of distribution. The old equipment included a number of Scannell horizontal return tubular boilers, several reciprocating engine units, and a varied assortment of dynamos, all of which were operated by belts and countershafts. The commercial incandescent service was handled by one 288-kw Stanley two-phase, 133-cycle, 2,300-volt inductor alternator, and by two 120-kw General Electric 125-cycle, alternators wound for the same voltage. Loads were not shared by these machines in parallel operation. Street lighting was handled by one 120-light Brush arc generator 9.6 amperes, one 40-light and one 50-light Brush machine of the same current rating, one 40-light T-H arc dynamo, a

FIG. 1.—GENERAL VIEW OF INTERIOR OF HAVERHILL STATION.

120-light, 6.6 ampere Brush machine and two 50-light T-H machines. Power service was entirely on the direct-current basis, the business being handled by two 550-volt General Electric generators, one being rated at 500 kw, and the other at 300 kw.

Besides the lack of economy which this equipment was characterized by, there was practically no room in the plant for expansion. As business increased the need of reorganization became more insistent, and it was decided to remodel the old plant in preference to building an entirely new one, doing the work as far as possible without interrupting the service. The old station contained a basement in which was set up shafting for the transmission of power from the engines to the dynamos; this basement was altered in the new station by taking out the original engine room floor and turning the engine room into a single compartment with a raised section at the west end, and a second raised section above this for the switchboard location.

The power plant is a brick building with concrete foundations, the engine room being 95 ft. long by 72 ft. wide. At one end is a boiler room, 60 ft. by 72 ft., and at one side of this is a pump, locker room and lavatory. At one end the building was extended for 18 ft. with a width of 55 ft. to house the switchboard and its appurtenances. The power house property occupies an area of 38,400 sq. ft. Coal is stored in the yard outside the plant, and carried in wheeled trucks to the end of the boiler room as it is needed in the pocket, which is a sheet steel cylinder lined with concrete and suspended above the boilers. The pocket has a capacity of about 300 tons. Coal is crushed in a motor-driven crusher made by the Steel Cable Engineering Company of Everett before being delivered to the pocket. The crusher motor is a 10-hp, 550-volt induction outfit. The coal is delivered to the overhead pocket by a Robbins belt conveyor and bucket system. Adjustable hoppers and chutes equipped for longitudinal travel in the boiler room deliver the coal by gravity to the boiler furnaces through Roney stokers. The coal is weighed mechanically as it descends from the pocket to the

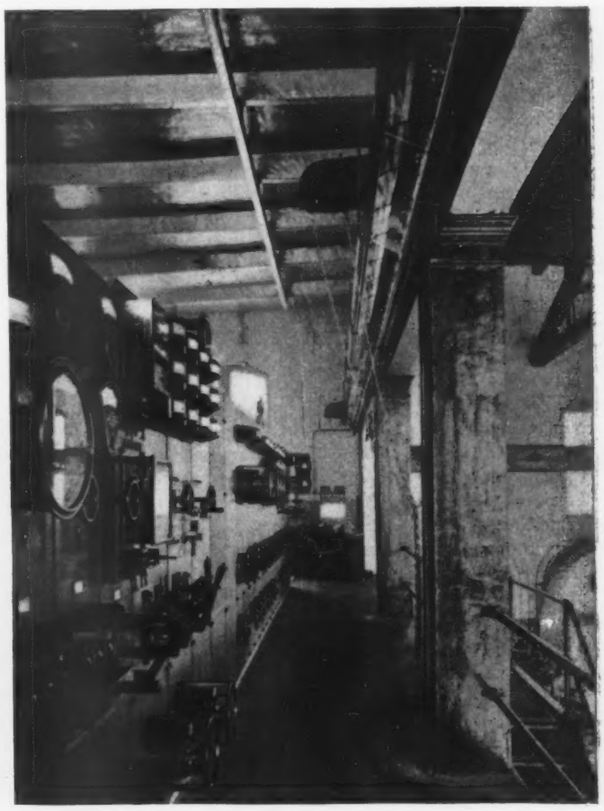


FIG. 2.—SWITCHBOARD, SHOWING METHOD OF LIGHTING AND FIRE-PROOF CURTAINS.

stokers. The conveying system is driven by a 10-hp, 550-volt induction, three-phase motor, and the descending spouts of the chutes are operated by hand chains. The stokers in the plant are normally driven by a 10-hp motor, but an auxiliary drive is provided in the shape of a 4½x4-in. Westinghouse standard engine.

The active boiler equipment of the plant now consists of three 650-hp Altman & Taylor type B. & W. water-tube units, each boiler having 294 4-in. tubes. The operating steam pressure is 160 lbs. Cahall superheaters are provided on two of the boilers, the third being equipped with a Foster superheater. A Sturtevant fuel economizer is also installed in the plant. The stack is of brick, 123 ft. high and 6 ft. in inside diameter, and the boilers are equipped in addition for operation under forced draft, two 8x10-in. engines being installed to operate an 8-ft. Sturtevant fan.

Two systems of ash handling are installed. At one end of the boiler room is a special ash bunker into which ashes can be delivered by the conveying system and temporarily

stored prior to removal. This bunker is elevated above the boilers and it delivers through a chute to the ash car or barrow used to take the ashes away. The other plan is the washing of the ashes away by hydraulic power to the flats along the river bank. Water can be turned into the ash pits at any time, and the ashes removed through suitable conduits which connect with the river banks.

The present main generating units are driven by two reciprocating engines and two steam turbines, so the piping was designed with more than the usual flexibility. It was desirable to use either saturated or superheated steam in the prime movers and auxiliary engines, and to enable this to be done, two steam mains were brought in from the boiler room, one being a 12-in. live steam line devoted to superheated service, and the other a 14-in. saturated steam line. Both of these trunk lines are carried through the boiler room across the tops of the three A. & T. boilers; the saturated steam header is fed by 10-in. risers and the superheated line by 8-in. supply pipes. The two mains are cross-connected near the middle of the boiler room with a suitable valve in the connecting line. This arrangement increases the flexibility of the system because it enables the boilers to feed around any broken section of piping with the minimum delay.

In the engine room the 14-in. saturated steam main is carried past all the prime movers to a dead end underneath the turbine gallery. Between the two turbines a large T connection is made with the further end of the 12-in. superheated steam line, and by means of valves in each side of the T the turbines or engines can be fed with either superheated or saturated steam, or the turbines can be run on superheated steam and the engines on saturated, simultaneously. In other words, the two live steam supply lines form a closed loop from which either superheated or saturated steam can be taken, according to the end of the loop from which the prime mover draws.

There are two Blake duplex outside packed plunger feed pumps, cylinders 10x6x10-in., in the pump room. These are mounted on concrete foundations at a height sufficiently above the floor to enable them to be readily inspected by the power house operating shifts. They are each supplied with live saturated steam by 1½-in. pipes connecting with a 4-in. line that runs to the boiler room. From this 4-in. line two Westinghouse steam-driven air pumps in the pump room also are supplied with steam, as well as the engine which is equipped to operate the Roney stokers and the Sturtevant fan engine. The economizer scrapers are run by a 3-hp motor. The air-pumps are used to supply compressed air throughout the plant for cleaning purposes. The lavatory is equipped with open plumbing toilet and porcelain bath, a shower bath also being provided for the use of the men.

Four of the old 72-in. Scannell boilers were left in the plant when it was remodeled, and these are available for service if necessary. Each has 92 3-in. tubes 20 ft. long. The boiler room is unusually compact for its capacity and total equipment, and there is no doubt that a contributory cause is the use for mechanical stokers. The old boilers are not fitted with stokers. At one end of the pump room is a Whitlock coil pipe heater for feed water service. It is supplied with steam from the auxiliaries in connection with the engines and turbines.

The turbine sets are each composed of a 1,000-kw. Westinghouse-Parsons turbo-alternator wound for 2,300 volts, three-phase, 60 cycles, the normal speed being 1,800 r.p.m. They are mounted on concrete foundations in the raised portion of the engine room, which is about 6 ft. above the floor of the old basement. The turbine line steam pipes are 6 in. in diameter each.

Of the reciprocating engines, one is an 18x32x42-in. cross-compound Harris-Corliss machine, normal speed 105 r.p.m., and the other a 19½x34x30-in. Harrisburg-Corliss tandem compound engine running 125 r.p.m. The live steam supply pipe of the former is 6 in. in diameter and that of the latter 7 in. Both of these supply lines connect directly with the 14-in. saturated steam main. These two engines drive two 500-kw, 550-volt, direct-current generators separately for local power service. The Harris-Corliss engine exhausts into a 10x20x24-in. Deane horizontal air pump and jet condenser, and the Harrisburg-Corliss into a 10x18x15-in Blake simplex vertical air pump and jet condenser.

The condensing system of the turbines is of the surface type, Worthington make. The auxiliary steam engines receive their supply through a 5-in. main which connects with the main 14-in. saturated steam header of the engine room. Each turbine has a separate surface condenser of 4,500 sq. ft cooling surface, the main turbine exhaust being 24 in. in diameter. The usual wet vacuum, dry vacuum and circulating pumps are provided, the dry vacuum pumps being mounted upon the floor of the turbine room on a level with the turbines. The other pumps are in a special basement beneath the turbines. All are steam driven, the circulating pumps being of the centrifugal type make-up and cooling water for the system is drawn from the Merrimack River through a supply duct leading to a well 19 ft. deep and 10 ft. in diameter, beneath the floor of the turbine room basement. At the river end of the supply duct is a motor-operated gate valve which is controlled from the power house basement. A system of pilot lights shows the position of the gate valve at any time. The water in the Merrimack River varies considerably

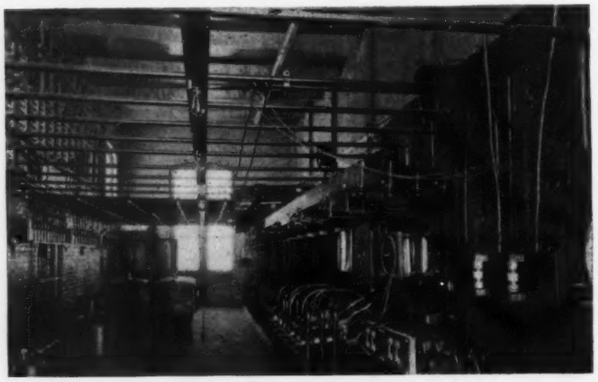


FIG. 3.—BACK OF SWITCHBOARD.

in height at different seasons, and it was essential that this means of preventing overflows should be installed and kept in constant working order.

The water drawn from the well and passed through the surface condensers is returned to the river by a separate discharge tunnel, the circulating system forming a siphon so that the only work the circulating pumps have to do is to overcome friction in the pipes, tunnel and apparatus. Merrill twin strainers are used in each of the circulating water supply pipes, so that one strainer can be cut out for cleaning without interrupting the flow of water through the system. Jewell filters are used to clean the feed water before it passes into the boilers. The gate valve water at the river end of the supply tunnel is of 5-hp rating.

Beneath the floor of the turbine and engine room an exhaust main varying in diameter from 14 in. to 16 in. is run, with 16-in. connections to the turbines and 14 in. and 12-in. connections to the reciprocating engines. This main terminates in a 16-in. riser which discharges into the atmosphere at the top of the roof when it is desired to run the plant non-condensing. The exhaust from the turbines is normally condensed and used over again in the boilers, but the exhaust from the reciprocating units, from the wet vacuum, dry vacuum, circulating pumps, and other auxiliaries is gathered up in a 12-in. trunk line and passed through the Whitlock heater previously mentioned. The heater condensation is then thrown away into the river.

Besides the turbo-alternators and the 500-kw units, the station contains several motor-driven generating sets, including two 125-light 9.6 amperes Brush arc dynamos, each belted to a 100-hp. 220-volt, three-phase Westinghouse induction motor, a 62-kw,

550-volt, direct-current generator belted to a 2,200-volt, 125-hp General Electric three-phase motor, and a 50-kw exciter driven by a 75-hp direct-connected induction motor. There is also a 50-kw exciter 125 volts, driven by a 14x14-in. vertical Shepherd engine. All these units except the 62-kw machine are installed close by the turbines at the west end of the engine room. The 62-kw generator is an old bipolar outfit, but it carries the direct-current power load from 9 p. m. to 6 a. m.

The arrangement of the switchboard at Haverhill is one of the most interesting features of the plant. As was pointed out above, the switchboard is mounted in a separate section of the building, and it is installed about 10 ft. above the turbine room floor so that from the gallery a commanding view of the entire engine room can be had. An open space cut in the wall in front of the switchboard is equipped with three steel roller curtains which can be instantly dropped down to shut off the switchboard from the engine room in case of fire. The switchboard consists of 27 black slate panels with dull, oiled finish, and it is illuminated by a special spherical reflector mounted over the gallery in front of the panels.

The bus-bars, field rheostats and transformers for the various motors in the station are mounted in the basement of the switchboard house, the two first named being installed beneath the ceiling on suitable insulated hangers. The result is a remarkably clear switchboard back. The only bus-bars carried on the back of the board are those for exciter service. Oil switches are mounted directly on the rear of the board and the 2,300-volt circuits are brought to these, but the runs of cable are short and well insulated. About 12 ft. of clear space was allowed between the rear of the switchboard and the wall. The wiring passing out of the building is carried in straight lines with short bevels and can be readily traced.

The panels exhibit the variety of service in the plant. There are two 550-volt, direct-current panels, a station lighting panel equipped with switches which control the various sectionalized lamp circuits in the plant, an alternating-current exciter panel and a direct-current exciter panel; a regulating panel containing two Tivell regulators (one as reserve) and a bus locking switch used to tie the two sets of 2,300-volt, three-phase bus-bars together when necessary; two 1,000-kw turbine panels, four three-phase feeder and alternating-current power panels, two single-phase lighting circuit panels, four panels for constant-current transformers, used at present in connection with the Brush arc machines for street lighting, and the remainder are blanks. All the feeder oil switches are automatic, with time limit relays, generator oil switches being non-automatic. A desk for the attendant in charge of the switchboard is set up on the end of the switchboard gallery, and above it is a list of framed instructions giving the capacity of each panel and generator in the station, with rules for the operation and care of the switchboard and its parts.

The distributing circuits from the station are at present all overhead wiring, but beginning with 1908 a large part of the wiring in the business section will be placed underground. The principal outgoing circuits now are the 2,300-volt, three-phase power circuits, a 550-volt direct-current power circuit, three 2,300-volt, single-phase circuits and four municipal arc circuits. At the time of the change-over in the station equipment the main outgoing lines were thoroughly overhauled, and about two-thirds of the transformers had to be changed. Large units replaced smaller scattered ones to a considerable extent, but in view of the prospective underground work, no elaborate system of paralleled secondaries was installed. The work of changing over the station involved changing the connections of 300 multiple enclosed arc lamps in store service from 133 to 60-cycle operation, replacing 150 fan motors of the 133-cycle type, and changing a number of dental motors.

The Haverhill Electric Company has a large number of shoe manufacturers among its power customers, and in one case three of these located nearly two miles from the plant were supplied by 550-volt current. The circuits were not deficient in copper, but the service was far from the present standard on the score of voltage constancy. When the station was changed over, these three factories were supplied with 2,300-volt, three-phase power, and although 8 miles of No. 0 B. & S. copper wire were taken down on this line more than double the previous capacity remained on account of the change in voltage. These factories were formerly equipped with three or four motors each, but they are now equipped with from 25 to 30 three-phase induction motors each, the principle of splitting up the machinery into smaller group drives having been adopted. The result has been a much more flexible class of installation, a system which enables power to be used only in the departments which have to be in operation at any one time, and a greatly reduced quantity of power wasted in belts and shafting. The change was carried out with no interruption to the factory service, and the change at the station was made in a single day. In making the change every possible piece of work was planned and executed beforehand. The final cut-over was made on a Sunday, in order to give the least interference with customers.

The company has recently installed a three-phase circuit connecting its generating plant with the Bradford sub-station of the Boston and Northern Street Railway, on the opposite side of the river. At present 250 kw are called for, and part of the circuit consists of a No. 0 three conductor armored submarine cable laid on the bottom of the river. The cable is 700 ft. long and was laid in 5 hours through 14 in. of ice. A slot 8 in. wide was cut in the ice and the cable dropped to the river bottom by gravity. The capacity of the cable is adequate for the transmission of 600 kw when it is needed.

The officers of the Haverhill Electric Company are: President, C. H. Tenney; vice-president, F. P. Royce; manager, A. E. Tenney; treasurer, E. A. Bradley; secretary, H. P. Wood; local manager, H. T. Sands; electrical engineer, F. C. Sargent.

The Storage Battery in Telephony.

By C. E. PAXSON.

WERE it not for the storage battery the present low telephone rates would be impossible. Before the storage battery was considered as a central source of power in the telephone central office it was necessary to have a small battery at each of the many subscriber stations. These batteries were objectionable for the following reasons:

First, the cost of installation was higher, as more men were required to install the same number of stations per day, because of the greater weight and bulk of the subscriber station itself.

Second, the maintenance and inspection costs were great on account of complicated apparatus being at a distance from the central office.

Third, the cost of renewals was heavy.

Fourth, the batteries and a magneto hand generator, by means of which the subscriber could signal the central office operator, had to be mounted at the subscriber station, and, the most economical place being found to be in the set itself, the result was an unsightly appearance.

Fifth, when stations were not continually in use a loss in efficiency of electrical supply obtained on account of the battery standing idle.

Sixth, a magnetic drop was required at the central office which, on account of its size, had to be located away from its corresponding answering jack, thus preventing the large switchboard units which are possible in the common battery system and causing a delay in answering the subscriber call.

The ideal telephone system is one in which the smallest portion of a certain minimum amount of apparatus is at the subscriber station, and the remainder at the central office where but a small force is required for its economical operation.

One of the first experiments tried when investigating the practicability of using a single battery for a number of telephones, was made in New York City and was carried on as follows:

Two telephones were connected at the terminals of a retardation coil, as shown in Fig. 1, the other terminals of which were connected to an ordinary open circuit battery. The experiment was quite successful.

After this the number of telephones was increased, as shown in Fig. 2, and leads were run from a large number of batteries in the basement to connecting cords which were placed in a small switchboard on the third floor. When the conversation was between two persons only, the transmission was good; but when other conversations were being carried on at the same time, it was found that cross-talk interfered with the proper transmission of the messages. The trouble was finally traced

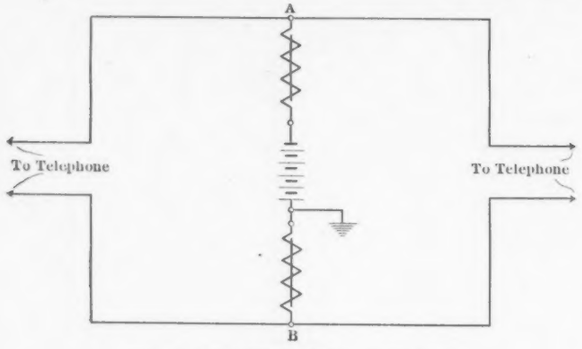


FIG. 1.—TWO TELEPHONES CONNECTED.

to the high resistance of the battery leads coming from the basement. The cross-talk was lessened, first, by increasing the size of these battery leads; and further by bringing the cells upstairs, and finally by placing more cells in parallel with those in use, decreasing the internal resistance of the battery and thus preventing a variable potential at its terminals, which produces cross-talk. The varying potential should be restricted to the ends of the retardation coil marked *A* and *B* (Figs. 1 and 2). It may be seen that if the internal resistance of the source of power be low enough no variation in potential will occur at its terminals.

As the current was to flow almost continuously from the battery it was suggested that the storage cell be tried. The

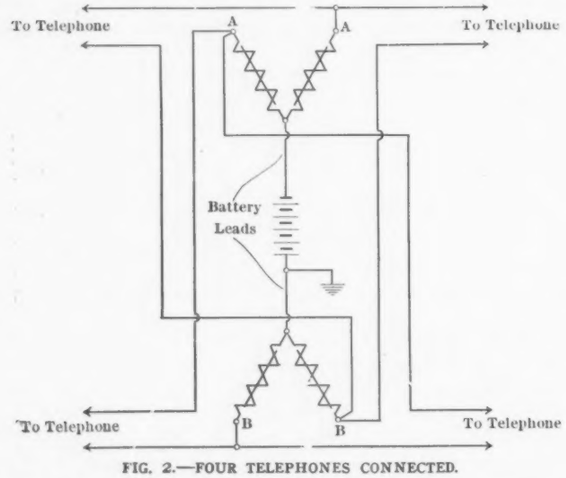


FIG. 2.—FOUR TELEPHONES CONNECTED.

experiment with this type of battery was very satisfactory because of the extremely low internal resistance. The upper limit of this resistance, including the resistance of the battery leads, has been found by experiment to be about .05 ohm. It will, therefore, be seen how much this characteristic increases the adaptability of the storage battery for telephone work.

The question of determining the capacity of the storage battery which would be required then arose. The potential to be used was determined by experiment. At first eight cells of chloride accumulator were tried. It was then found that better results obtained by increasing this to eleven cells, which gave satisfactory transmission. This number was not further increased for the reason that it was feared that the transmitters would not stand the current due to a higher voltage. In every central office to be constructed it is necessary to provide a storage battery of a certain capacity, which depends not only upon the number of lines to be operated and the rate of calling per line, but also upon the time of day in which the calls occur, assuming that we wish to charge the battery during the working of the day force.

In the past several approximate methods for determining the proper size of the storage battery have been used, but recently

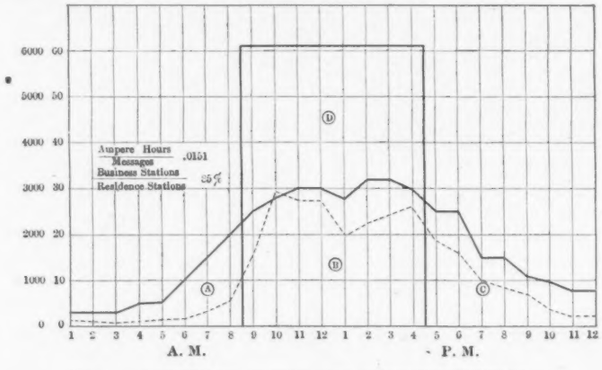


FIG. 3.—DISCHARGE CURVES FOR BUSINESS DISTRICT.

it has been deemed advisable to arrive at some more accurate solution of the problem.

Curves were plotted from hourly readings taken from the storage battery discharge of some of the larger central offices which were already partially equipped. Two of these curves are shown in Figs. 3 and 4. The full line curve shown in Fig. 3 was taken from a storage battery supplying a business district, while that shown in Fig. 4 represents a residence district.

As may be seen, the first peak in the business district curve occurs at approximately 11 a.m. During the dinner hour the curve drops off, but rises again for an increase in business transacted after dinner, and from 4 p.m. it drops off until at 1 a.m. it is practically nothing. These characteristics are also true in the residence district curve, but in addition to the fluctuation before and after dinner, we have what may be termed the theatre peak, which disappears soon after 7 p.m.

If we decide to run the charging machines during the day it may easily be seen that the battery in the residence district will have to be relatively larger than that in the business district.

There seem to be two good reasons for charging during the

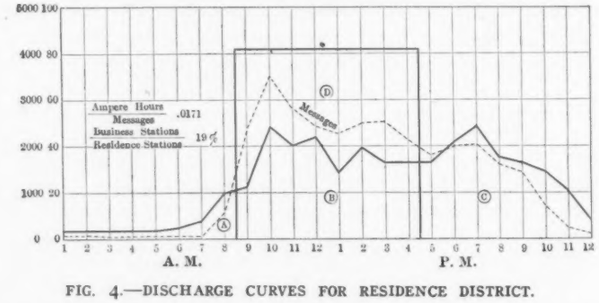


FIG. 4.—DISCHARGE CURVES FOR RESIDENCE DISTRICT.

day, namely, that the higher class men who are on duty at that time can superintend the work, and also that the generator may carry the heavier exchange loads and the storage battery the lighter. These facts apply as well to mercury arc rectifiers as to direct-current motor-generators and dynamos run by gas engines.

It is thought to be economical to run the charging machines for eight hours each day when the battery is fully loaded; that is to say, when all the lines, for which the particular battery was designed, are in service. The day force reports from 8

a. m. to 5 p. m., and it is therefore desirable that charging be done between the hours of 8.30 a. m. and 4.30 p. m.

The next thing to be decided is the ampere-hour efficiency which the battery may have when sufficiently deteriorated to warrant renewal. It is thought safe to place this at 75 per cent, as the efficiency of a new cell is almost 100 per cent. Batteries under normal central office conditions appear to last about 5 years.

The areas $A + C$ in Figs. 3 and 4 represent the ampere-hours which must be supplied by the battery alone—that is when the generator is not running. The required capacity of the battery is represented by the area D, which is obtained by increasing the area $A + C$ by 33⅓ per cent. The size of the charging generator is represented by the area $D + B$, the portion D being required for the battery and the portion B by the central office; that is to say, the generator must be run at a rate represented by the top line of area $D + B$ so that the battery may last from 4.30 p. m. until 8.30 a. m. the following day.

When additional equipment is to be placed in a central office, the size of the battery may be determined as follows: Readings for twelve curves similar to those shown in Figs. 3 and 4, should be taken at equal intervals throughout the four seasons of the year. No readings should be taken on Saturdays or Sundays on account of the light load.

In addition to taking the ampere readings at the end of each hour, the message readings should also be taken, shown in Figs. 3 and 4 by broken lines; that is to say, the number of messages, outgoing and incoming, occurring during the hour, should be plotted at the end of each hour. The ampere-hour curves should be compared with the corresponding message curves, and the approximate ratio of ampere-hours to messages obtained.

The number of messages to be expected per day may be determined by knowing the calls per station at present, the stations per line at present, and the lines at present; also the lines after the addition has been made and the probable lines per station, and the stations per call which may be expected by the time all lines are connected to working subscribers' stations.

After the total number of messages is obtained, this number is multiplied by the largest ratio of ampere hours to messages recently obtained from the curves. We then have the total ampere-hours required by the central office for messages. The largest ratio between the areas $A + C$ to the corresponding areas B (see Figs. 3 and 4), is then computed from the curves, assuming that charging is done between the hours 8.30 a. m. and 4.30 p. m. Then $A' + B' + C' =$ total ampere hours $= Y$, and $\frac{A' + C'}{B'} = X$, from which we must find the areas B' and $A' + C'$. The primed letters represent the areas of the curve from which the sizes of the battery and generator is to be determined. Solving the equations, we find $B' = \frac{Y}{X + 1}$. Subtracting then B' from the total area, $A' + B' + C'$, we have $A' + C'$.

From previous statements, the battery size is determined by $4/3\ (A' + C')$. The generator size is given by $4/3\ (A' + C') + B'$, and dividing this amount by 8.

It may be seen by these formulæ that the greater the value of $\frac{A' + C'}{B'}$ or X, the larger the storage battery must be, and the smaller the relative size of the generator.

In case we have to design a battery for a new central office, we encounter some difficulty with the ratio spoken of as X in the previous calculation, and also the proper number of ampere-hours per message to be used. In offices, where the ratio of business to residence telephones was 19 per cent, the ratio X was found to be 94 per cent, while in offices in which the business to the residence ratio was 85 per cent, the ratio X was found to be 78 per cent. It is thought safe to assume a straight line between these points in determining the ratio X for all offices.

In connection with the proper number of ampere-hours per message to be used, referring to the residence district curve in Fig. 4, it will be noticed that before 8.15 a. m., and after 5.30 p. m., the message curve falls below the discharge curve, which means that calls are of longer duration than during the busier hours of the day, thus requiring more ampere hours for each message.

Referring to the business district curve, it will be seen that the large area, between the discharge and the message curve, and between the hours of 12 noon and 4 p. m., is probably due to the interior private branch exchange messages which are not represented by the message curve.

Referring to both curves it will be noticed that the average ampere-hours per message is approximately the same in each, even though the ampere hours per message in a business district may be expected to be lower than that in the residence district on account of the calls being of shorter duration. It is thought that the actual average ampere-hours per business message is increased to practically equal the average ampere hours per residence message by the great number of private branch exchange messages. It therefore seems safe to assume this figure constant for all offices.

We have now considered the methods of design of central office storage batteries from the point of messages. The batteries are, however, called upon to run small motor-generators at certain times, but, as these require a constant current, it is simply necessary to increase the height of the curve for the hours during which the machines are expected to be run, by this constant amount. The calculation from this point on, is the same as that previously outlined.

Multiplex Telephony.

BY CHARLES S. WALDEN.

It is but natural that those of an inventive turn of mind should have made attempts early in the development of the telephonic art by which a telephone circuit might be used for several simultaneous conversations without interference.

Quite a number of the ideas developed have their fundamental principle contained in a patent for a "telegraph circuit" issued to Frank Jacob in England in 1882 and in this country in 1883 (No. 287,288). This is a plan by which two metallic circuits are combined through proper resistances, arranged on the principle of a Wheatstone bridge, so that a third non-interfering circuit is formed, using the earth for one conductor and the above combination for the other.

Apparently the first patent for a multiplex telephone circuit was issued to J. A. Barrett in 1886. This was a system similar to the principles contained in the telegraph circuit above referred to; also the combination could be so arranged that a metallic circuit could be utilized in connection with the ground return and thus form a duplex. Subsequent patents followed, and to date about 28 patents for multiplex telephony have been issued. These cover every conceivable combination and arrangement of circuits in order to produce the desired results, and as is the case in all classes of subjects, there appears the "freak" type and others that while they may not come under the heading of "freaks" are far from being capable of practical application. *Per contra* some of the best engineering talent has contributed to the cause and brought out good designs.

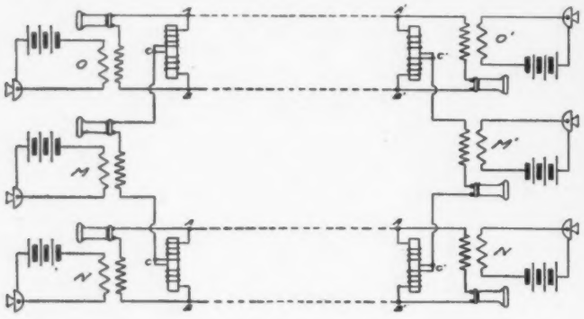
In its simplest form the theoretical design of a multiplex circuit would consist of two metallic circuits of equal length and of the same electrical dimensions, combined through differentially-wound retardation coils so as to form a third circuit; this arrangement is illustrated in Fig. 1. The coil connected across the circuit AB is a single core coil with two windings so arranged that connected in series from A to B, the retardation is maximum; whereas connected in parallel (CA and CB) the magnetic effect is nil.

It will be seen that current from the telephone M or M' ar-

riving at the point *C* or *C'* divides and an equal amount passes to *A* and to *B*. The two line wires *A* and *B* being of the same potential sign at any particular instant, there is no difference of potential and hence no flow of current from one wire to the other through the telephone *O* or *O'*. Under these conditions three conversations may be carried on simultaneously.

To obtain a retardation coil of the proper type it is necessary that the two windings upon one core be wound simultaneously so that the wires are side by side, and that one winding equals the other, both as to ohmic resistance and magnetic effect. As stated before, the line wires of both circuits should bear an equal relation to each other as to length, resistance, leakage and other electrical dimensions. It would furthermore necessitate their being run upon the same poles and situated with respect to each other so as to produce a balanced condition.

While these conditions can be obtained in the laboratory it is



MULTIPLEX TELEPHONY.

difficult for them to be even approximated under commercial conditions, and even if these conditions are established they are liable to be upset by natural causes. From this it will be seen why duplex telephony has as yet not become a prominent factor.

Motor-Driven Pumping Equipment at Seattle.

One of the most important of recent installations making use of electricity as motive power is the pumping plant of T. W. Hawley at Seattle, Wash. The plant mentioned is being operated in connection with one of the several hydraulic sluicing systems now engaged in the removal of earth from the hilly section of the city of Seattle.

FIG. 1.—SIX-INCH GIANT WORKING ON DENNY HILL.

Heretofore water has been secured for sluicing from the city water system which derives its supply from Cedar River, distant approximately thirty miles from the city, but owing to the recent large increase in demand upon the city plant consequent to the rapid growth of the city, the municipal authorities have been compelled to discontinue the disposal of water for purposes other than those usually imposed upon such a system. Owing to this condition it was decided to install a sea water pumping plant taking water from Puget Sound at a point approximately 2,500 ft. distant from the point of consumption, for the purpose of removing Denny Hill, one of the landmarks of Seattle, and the site of the Washington Hotel, as seen in Fig. 1.

The plant consists of a 600-kw, 2,400-volt, two-phase, 60-cycle Westinghouse synchronous motor to which is direct-connected a 40-hp, 440-volt, two-phase induction starting motor mounted on an extension of its shaft, as shown in Fig. 2. The induction motor is controlled through an auto-starter mounted on a separate panel of the switchboard in the regular manner.

FIG. 2.—MOTOR AND AUXILIARIES AT PUMPING PLANT.

Electricity for the operation of the plant is obtained from the system of the Seattle Electric Company. The two-phase, 440-circuit for the starting motor is passed directly from transformers placed on a pole outside of the station to the starting motor panel. The 2,400-volt, two-phase circuit is carried to disconnecting switches placed outside the building and thence to a feeder panel.

The switchboard consists of two panels containing voltmeters, ammeters, automatic oil circuit-breakers, a synchroscope and the necessary bus-bars and small wiring. The exciter is driven from a pulley mounted on the main shaft of the synchronous motor, and is controlled from the operating panel of the switchboard.

Power is mechanically transmitted to a 30-in., four-stage Worthington turbine pump, through a friction clutch of special design to the main driving pulley, which is belted to the pump pulley through the medium of a 48-in., four-ply leather belt. The belt tension is adjusted by raising or lowering an idler pulley placed about 12 ft. from the pump pulley. The pump has developed a capacity of 4,000 gallons per minute against a gauge head equivalent to 430 ft. and is capable of delivering water at the nozzle of a 6-in. giant working at the highest elevation required at a pressure of 120 lb. per square inch. The matter to be excavated consists largely of blue clay and is exceedingly tenacious and difficult to move. However, no difficulty has been experienced in the present instance, and the plant has proved to be thoroughly satisfactory in every way.

The hydraulic end of the plant was designed and furnished by Caldwell Bros. Co., of Seattle. The electrical portion of the plant was designed and erected by the Kilbourne & Clark Company, of Seattle, under the supervision of Mr. Frederick G. Simpson, chief engineer of that company. All other parts of the installation were installed under the direction of Mr. George H. Tinker, engineer for Caldwell Bros. Co.

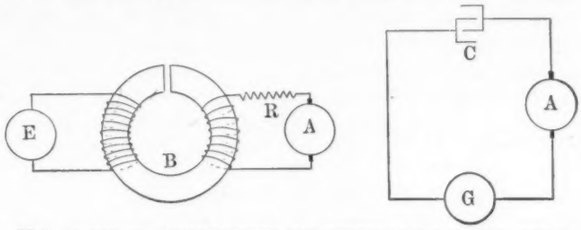
Means for Determining Small Rate of Speed Changes.

BY A. P. YOUNG.

FOR the determination and separation of the losses occurring in large direct and alternating-current machines, use is frequently made of the retardation method, which is particularly applicable in the case of turbine-driven generators. The principle upon which this method is based is that at any instant during the retarding period the retarding torque acting on the rotating mass is directly proportional to the rate at which the speed is changing at that particular instant.

The object of this article is not to enter into the theory of the retardation method, but to describe a method by which the angular retardation can be experimentally determined. The usual method of obtaining the value of the retardation is by aid of a speed-time curve, the slope of which at any particular point obviously gives the value of the retardation. The method is somewhat tedious and entails rapid readings of a stop-watch and tachometer, so that a direct means of determining the retardation should be of advantage.

In the method outlined below, a small constant-field direct-current generator is belted to the main shaft of the machine and is used to supply current for exciting an iron core upon



FIGS. 1 AND 2.—CONNECTIONS FOR DETERMINING SMALL SPEED CHANGES.

which is wound a secondary coil which is connected to an electrometer. Fig. 1 shows a diagrammatic view of the arrangement. Here *A* represents the armature of the direct-current generator; *R* the iron core, and *E* the electrometer, *R* being a variable resistance inserted in the primary circuit for adjusting the current.

It is easily seen that as the small generator, *A*, runs at a speed proportional to the speed of the machine under test, the current passing through the exciting coil will at any instant be proportional to this speed. Thus the flux threading the secondary coil may be considered as being proportional to the exciting current and therefore to the speed of the machine under test, this being very nearly the case if the flux density in the iron varies between limits corresponding to the straight part of the saturation curve. By interposing a small air-gap in the magnetic circuit, as shown in the diagram, it is possible to obtain a good proportionality between the flux and the exciting current. Therefore, the e.m.f. induced in the secondary winding, which is proportional to the rate of change of the flux, is at any instant proportional to the rate of change of the speed of the machine under test and thus to the angular retardation.

The induced voltage is measured by the electrometer; it is essential that the instrument used for this purpose is of the electrostatic type, so that practically no current is taken from the secondary winding; otherwise the current would produce a counter flux and thus complicate matters.

In making the test, readings of the electrometer are taken at regular intervals as indicated by a stop-watch, and from the readings thus obtained the retardation can be derived if the instruments are properly calibrated from known speed changes.

Fig. 2 indicates a second method in which the iron core and its windings are dispensed with. Between the terminals of the generator, *A*, a condenser, *C*, is connected in series with a galvanometer, *G*. As before, the voltage of the generator terminals, that is, the potential difference across the condenser, is at any instant proportional to the speed of the machine under test. If the speed, and therefore the impressed e.m.f., remain constant, no current will flow in the circuit, but when the speed changes a current will flow which is proportional to the rate of change of this speed. Therefore, the current indicated by the galvanometer is proportional to the retardation.

Five Thousand-Volt Fuse Carriers Used at Detroit.

The question of satisfactory fuses for heavy-power circuits of from 2,000 to 5,000 volts, suitable for use on distribution pole lines, is becoming daily more serious. There are now a number of large central station companies which are distributing power to wholesale customers for operation of large

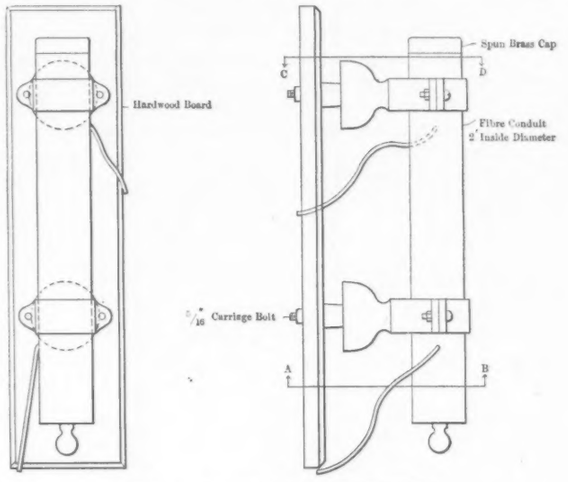


FIG. 1.—5,000-VOLT FUSE CARRIER.

manufacturing plants and the like. While these customers would be large enough to justify separate feeder circuits with station circuit breakers if they were supplied from a small or moderate size central station, it becomes necessary in a very large distributing system to supply a number of these whole-

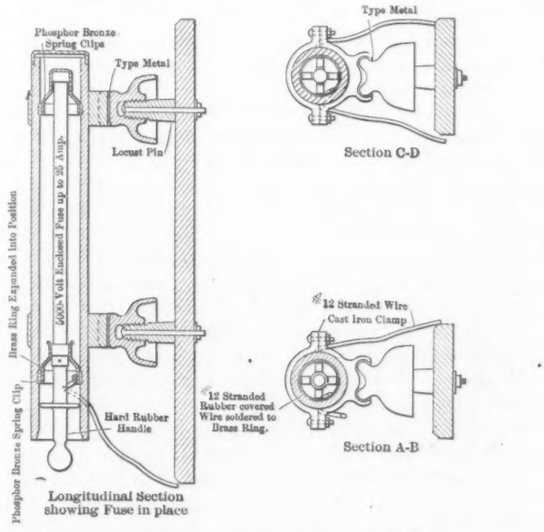


FIG. 2.—DETAILS OF 5,000-VOLT FUSE CARRIER.

sale customers by branches from certain main power distributing feeders.

One of the places in which this question came up is Detroit. The Detroit Edison Company (as described in the ELECTRICAL WORLD AND ENGINEER about two years ago) erected a large generating station in the outskirts of the city and began an active campaign to secure as customers the various manufacturing plants of the city. The voltage of transmission from

the generating station to the various sub-stations is 4,600 three-phase. Large power consumers are not supplied through the sub-stations at the usual standard direct and alternating-current voltages, but are fed from the 4,600-volt lines. This brought up at once the necessity for fuses for customers' branch circuits supplied from these transmission lines. The fuse now used and designed in Detroit is shown by Figs. 1 and 2. It consists of a 25-ampere (or less) 5,000-volt enclosed fuse, held in a case or carrier which is supported on insulators on the pole and held in a vertical position. The case is a piece of fibre conduit, 2 ins. inside diameter. Into this are expanded two brass rings, to each of which four phosphor-bronze clips are fastened. The enclosed fuse is inserted from below by means of a hard rubber handle to which it is attached. A spun brass cap is put over the top of the case. A number of these 25-ampere fuses have been short-circuited on the company's 4,600-volt station bus, and all have opened the circuit in good shape. Of the fuses that have blown in the service, a few have failed to open the circuit and burned up. This has always occurred during lightning storms, and the company's engineers have attributed the failure of the fuses to abnormally high potential on the lines during the lightning discharge. No difficulty has been experienced with moisture getting into the fuse tubes.

Electrification of Steam Railroads.

By H. Ward Leonard.

Mr. J. J. Hill, in a recent letter to Governor Johnson, indicated that the only solution of the existing problem of traffic congestion lay in the construction of additional trackage, and estimated that 75,000 miles of new tracks must be laid within the next five years to relieve the situation. In his letter, Mr. Hill says:

"There are, and will be, cars enough to carry the country's traffic if the cars can be moved, but engines and cars must have tracks upon which they may run. . . Not only were there 35 per cent more locomotives and 45 per cent more cars in service in 1905 than in 1895, but each engine and car did much more work. . . The average speed of a freight train is from 12 to 15 miles an hour."

These quotations from Mr. Hill's letter show clearly that he considers that increased trackage is the only possible way of increasing the capacity in the case of the best managed railways, which are suffering from freight congestion, notwithstanding the fact that they have the best modern equipment of steam locomotives and cars and are employing them to the best advantage.

But it will be evident that if we can double the average speed of a freight train, making it about 24 to 30 miles per hour instead of 12 to 15 (which Mr. Hill gives as the present rate) we will at once double the capacity of existing tracks. And, again, if we can double the average train load, we will thereby double the capacity of the existing tracks, even if the present average speed be adhered to. Hence, it will be apparent that if electrification offers a method of efficiently and safely applying to a train four times the average power in use to-day, the result will be that existing tracks will have four times the capacity they have to-day.

The elevated railway in New York city and the Broadway surface lines are familiar examples of how, without increase in trackage, the capacity of a railway line has been vastly increased by electrification, with benefit to the public and profit to the railway.

A trunk-line railway manager would, no doubt, say in answer to the above that these facts are familiar to all railway men; but that, while electrification for passenger service in and about cities has been successful and profitable, electrification of trunk lines is uncommercial and practically impossible. If asked why this is so, he would probably answer that it is well known that America leads the world in electrical matters and that the representatives of the only two electrical companies who are in the electric railway field in this country and who have knowledge of the latest and best inventions and every reason for using them, assert that trunk-line electrification is not as yet commercially practicable.

Just as long as railway managers foolishly imagine that two American electric companies must lead the world in electrical engineering and that these two companies are competing for meritorious inventions in the electrical field, progress in the electrification of railways must wait on European developments.

Since the problem presented by the enormous increase and consequent congestion of freight traffic in this country is not a problem with which any European electrical concern is dealing, their work in the immediate future in operating by electricity freight trains which are only one-quarter of the weight we already haul by steam, is not likely to prove of great value in solving the problem of how to apply greatly increased power to a modern American freight train.

It is a self-evident fact that there are no inherent reasons making it impossible to apply to a freight train by electricity any desired power within reason, and that inventions which would render this commercially possible may even now be in existence, and could be promptly utilized if a demand existed for them. If such inventions do exist, does it follow that the railways would be able to promptly take advantage of them? I answer "No," and cite as reasons the following facts:

First, there is no competition for inventions between the companies who equip electric railways in this country; and

Second, the steam railways have not created any demand for such inventions, because they have been satisfied to await the slow forward drift of a monopolized industry, instead of independently securing a competent expert opinion of the existing state of the art.

What is the practical solution of this situation? The best solution which occurs to the writer, is for some enlightened railway to follow the procedure employed as to the Niagara transmission—the most progressive and best piece of electrical engineering work ever done in this country, and possibly in the entire world. In that case an International Commission was organized, of which Lord Kelvin was the head, and which included many of the best qualified engineers in the world. Only one member of this commission was an American, and he was not an electrical engineer.

After mature deliberation the plans decided upon were announced. The commission had taken advantage of the best inventions of every land and had decided upon entirely novel designs and methods, which no one manufacturer, and no one country, was able to produce. Their plans were severely criticised by manufacturing interests, inventors and electrical engineers all over the world, but with the perspective afforded by 13 years, and innumerable duplications of their plans, it is conspicuous that an unparalleled progressive step in engineering was taken by this commission, which was of inestimable importance to the world, and which could never have been taken had the capitalists interested relied upon the engineers in the employ of any one or two companies, or the engineers of any one country.

The conclusion is obvious: An International Electric Railway Commission offers the only way of securing competent, disinterested, up-to-date knowledge as to the possibilities of trunk line electrification and, in the opinion of the writer, the Niagara Commission, or an equivalent one, would give an unqualified endorsement of the proposition that electrification is to-day the best solution of traffic congestion, and that in the present state of the art which would be presented to such a commission, trunk-line electrification is not only commercially practicable, but extraordinarily profitable, as compared with any other method of increasing the traffic capacity of our railways.

No railway manager would listen to, or could correctly appreciate an important invention in this line. The inventor would be advised to go to the leading electrical manufacturers, whose shops are crowded with profitable orders for standardized goods, which they, as experienced manufacturers, will not change until

they are obliged to do so, when forced to slowly follow European progress. The sensible business policy for such electrical manufacturers to follow, is to sell their standardized product as long as the railways will take it, and postpone as long as possible the use of any invention which might interfere with such a policy. They realize that whenever they need any existing invention they can get it, as there is no other market in this country for electric railway inventions.

If the railways, because of their ignorance and prejudice regarding electrification, choose the most expensive way of obtaining increased capacity, namely, increased trackage, they themselves will be the chief sufferers.

For the limited power thus far employed upon freight trains the steam locomotive is preferable to the electric locomotive. The same statement is true as to horse cars relative to electric street cars, and as to horse-drawn carriages relative to motor cars, but in these fields the benefit of increased power is now clearly apparent.

The steam locomotive cannot much further respond to the demand for greatly increased power, and the electric locomotive can readily do so, and for that reason alone must, before long, be used upon the congested sections of our railways.

Mr. Hill estimates that five and one-half billions "should be spent before the commerce of the country can be moved properly." Whether this estimate of Mr. Hill's is conservative or not, the increased capacity desired can be obtained to-day by electrification, at a small fraction of the cost which would be necessary if the increased capacity is obtained by increased trackage.

New Telephone Patents.

NEW APPARATUS.

The hand microphone or combined transmitter and receiver, when used at a subscriber station, must be associated with some switching device to take the place of the usual hook switch. One arrangement frequently used abroad, consists of a stand with a pronged holder in which the instrument may be laid, the support serving as the switch actuating member. Another arrangement provides a switch in the handle joining the two parts of the instrument to be actuated by gripping the handle. The switch is actuated directly by a lever placed longitudinally in the handle and projecting normally above its surface. It is this type of switch which forms the subject of a patent granted to K. Weman, of Buffalo. His switch and lever are mounted together as a unit and the whole is let into the side of the handle. By this arrangement the switch may be readily removed for inspection while the parts maintain their working relation.

W. C. Plank, of Las Flores, Mexico, has invented a protecting antiseptic device for transmitter mouthpieces which consists of a roll of paper pressed up to fit inside the mouthpiece, where it may be clamped. Each layer of the paper has a line of perforations from front to rear, i. e., along the length of the roll. It is proposed for each user to provide a fresh lining for the mouthpiece by pulling out the innermost layer of the roll, tearing it off at the perforation.

A repeater is covered by a patent to A. L. Purcelle, of Boston. This consists of a ring magnet of two parts. Each is virtually a semi-circle, the one of steel, a permanent magnet, and the other of soft iron. At one joint of the ring a free hinge action is permitted, while between the plane opposing faces at the other joint of the ring, a wafer-like microphonic button is held. The receiving side of the repeater is a coil upon the soft iron part of the ring. The transmitting part includes a battery, an induction coil, and the microphone button. The varying received currents affect the microphone button by variations of pressure due to the varying magnetic pull across the air-gap of the ring, and also from such direct effects as the change of magnetic flux through the button may have.

NEW CIRCUITS.

An intercommunicating system worked out on lines rather different from those customary is shown in diagram in Fig. 1. It will be noted that the switching plug has no effect upon

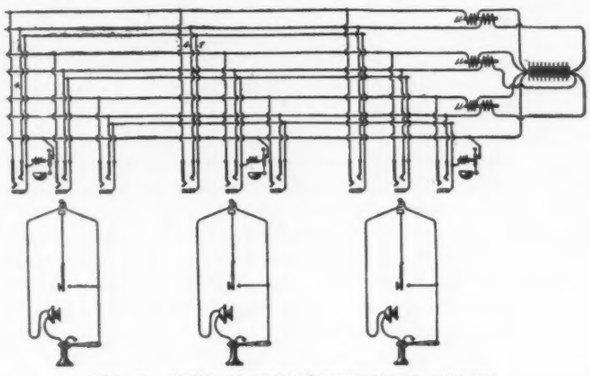


FIG. 1.—DEAN INTERCOMMUNICATING SYSTEM.

the receiving of signals at its own station, and therefore need not to be restored to any normal or zero point. The system is common battery, secret and so simple as to be self-explanatory. It has been patented by W. W. Dean and assigned to the Kellogg Company.

For calling circuits R. M. Eaton, of Philadelphia, has worked out a lock-out scheme so as to provide non-interference of operators. Usually calling circuits are available to a considerable number of operators, and at times there may arise confusion over right of way on the circuit. The present invention provides that as soon as any one carrying operator gets the line, all others are automatically excluded. Mr. Eaton's patent is assigned to the Keystone Company, of Philadelphia.

A trunk for connections between a two-wire switchboard, common-battery, and a magneto toll board, has been patented by H. G. Webster, of Chicago. The patent covers improvements in the handling of the magneto and common battery signals, and is assigned to the Kellogg Switchboard and Supply Company.

TELEPHONE DICTATING MACHINE.

Under this novel title K. M. Turner, of New York City, and F. H. Germer, of Hoboken, N. J., have jointly patented a combination of apparatus to permit one to dictate to any one of a number of distant stenographers from his desk, and to hear them read back and reply to their queries. The office set comprises switching and signaling means for each stenographer's line. A return signal indicates when the stenographer is ready with her receiver. Dictation is done before a sensitive transmitter and all replies and queries come over a line independent of the sending one. These replies may be switched to a head telephone or to a loud speaker at the will of the dictator.

TRUNK CIRCUIT.

Another trunk circuit for two-wire systems has been brought out by W. W. Dean and assigned to the Kellogg Company. The trunk is provided at both ends with both incoming and outgoing trunk apparatus. It is designed to be assigned from either outgoing end by the aid of a busy test on the jacks. The using of the trunk as outgoing at one end cuts off the incoming apparatus at that end and shows the trunk busy at all jacks. The use as an incoming trunk at an end, puts a busy test on all the outgoing jacks of that trunk at the same end, to protect the connection. The circuit is worked out for the Dunbar two-wire switchboard system.

ANTISEPTIC MOUTHPIECE.

G. E. Grimm, of Camden, N. J., has patented an antiseptic mouthpiece device. A sheet of metal is provided with guides along its side edges, while the top is curled back to form an open cylinder. The guides clamp the plate to the transmitter

mouthpiece, a hole being provided to center with that of the mouthpiece. A roll of paper is placed inside the cylinder, and then passed down between the guides, behind the metal plate, but in front of the mouthpiece. As new paper is pulled into place, the lower edge of the plate serves as a tearing edge to remove the used portions.

MISCELLANEOUS APPARATUS.

For special telephones for the deaf, it is at times advantageous to have a switch included in the receiver, which is of the watch case type. Mr. H. W. Haff, of New York City, has made a receiver with an insulated aperture in its shell, through which a plug attached to the receiver cord may be inserted. The tip of this plug engages one terminal of the receiver winding. The other terminal is connected to a switch which is controlled by a button passing through the casing. The switch member rides upon the sleeve contact of the plug to close the circuit, this plug sleeve serving as its stationary contact.

J. R. Challen, of Collegeville, Pa., is the inventor of a soft rubber cushion for the receiver ear cap. This is shown in Fig. 2. Its use is self-explanatory. A receiver hook with detachable lever forms the subject of a patent granted to C. C. Cadden, of Cleveland, Ohio. The switch is built up complete with a stub lever. The prong lever when placed upon the same spindle engages a pin on the stub lever, and a hook piece hinged to the prong lever may be depressed into a groove in the spindle to lock the whole together.

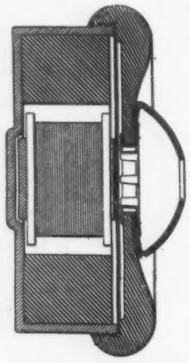


FIG. 2.—CHALLEN RECEIVER.

HARMONIC RINGING SYSTEM.

Among the party-line selective ringing systems using different currents for different stations, the harmonic system is one of the most interesting. With this system selection is accomplished by using currents of different frequencies for the respective stations, the bells of each of these being tuned to respond to its own proper frequency. This is the ideal situation, but practically there are other factors, some of which we have gone over in connection with recent patents. One of these factors to contend with is that a low frequency will disturb a bell tuned to a higher one. In order to overcome this, Mr. W. W. Dean has contrived an arrangement by which the current received by the harmonic bells varies inversely with the frequency. In the first place, each ringer has a condenser in its branch circuit and this is of smaller and smaller capacity as the bell frequency becomes higher. The small capacity condensers largely exclude the lower frequency currents. Again, the generator voltages are made higher with the higher frequencies. This again assists in keeping the low frequency currents out of the high frequency branches. The patent for this system is assigned to the Dean Electric Company.

Letter to the Editors.

Location of High-Tension Switches.

To the Editors of Electrical World:

Sirs:—In the article in your issue of February 23, on the substation plant recently built at Wellesley, Mass., a statement in the final paragraph in connection with the location of the switches appears to have been made through a misunderstanding by the writer of the object of the arrangement criticized.

The switches which he calls "Main knife switches" are used to break the incoming line only for the purpose of testing recording wattmeters, and even then they are never opened with any current passing. This testing will not be done very frequently, and, therefore, there is no reason that the switches should be located in a more convenient place than that assigned. In view of this infrequent use and also of the fact that there should be no metal parts so exposed that a person going behind the board for any purpose would be liable to come in contact with the same, it would seem advisable to have them out of reach. All of the high-tension apparatus was placed on the back of the board and kept off the wall for the reason that this latter location would bring high-tension work on both sides of a man going behind the switchboard, whereas with the plan adopted he now only has such work on one side and is thus better protected.

Boston, Mass. Hollis French.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Dynamos, Motors and Transformers.

Interpoles.—Pelikan.—Interpoles serve for the purpose of insuring sparkless commutation. This purpose is obtained by an artificial commutating field. Since any desired shape and size may be given to the commutating field, it might be possible to reduce the air-gap to the minimum required for mechanical reasons. In most cases, however, it will not be possible to use this minimum air-gap, because the occurrence of a one-sided magnetic tractive force would result in serious disturbances, especially at high speed. With induction motors in which this danger does not exist on account of the uniform distribution of the magnetic field, the air-gap may be made as small as possible. The author thinks that by an arrangement as shown in Fig. 1 the disadvantage mentioned above may be avoided for interpole machines, and that this construction will be especially suitable for high speeds. The illustration shows 12 main field coils, 11′, 22′, 33′, and four commutating coils, 44′. The design of such a machine is compared with an interpole machine of ordinary construction. The author finds that the iron weight would be about the same, while his machine would require somewhat more copper, but would have compensating advantages.—*Elek. u. Masch.*, February 24.

Calculating Electromagnet Coils.—Edler.—A supplementary note to his former article. He gives a further and more complicated example showing how to use his formulas, tables and curves.—*Elek. u. Masch.*, February 24.

Lamps and Lighting.

Efficiency of Incandescent Lamps.—Russner.—An account of some measurements of the proportion of the total radiation of the incandescent lamp which is transformed into light. For two carbon incandescent lamps he found this amount to be about 0.6 per cent. for a tantalum lamp 2.2 per cent, for an osmium lamp about 2.3 per cent, and for an osram lamp 2.46 per cent.

The results are only preliminary.—*Phys. Zeit.*, February 15.

Testing Lamps.—The conclusion of the discussion of the recent paper by Paterson. Ayrton emphasized that what is wanted from life tests is not only their useful life, but also average watts per candle during useful life, and the average watts cannot be obtained by merely taking the extreme values. Harcourt gave information on the effect of external conditions on flame standards. Paterson, in his reply, referred to one point which several speakers had raised, namely, that the lamps should be tested under the actual conditions under which they were used. He could not agree with this suggestion. What the consumer wants to know is not exactly the life of the lamps, but whether

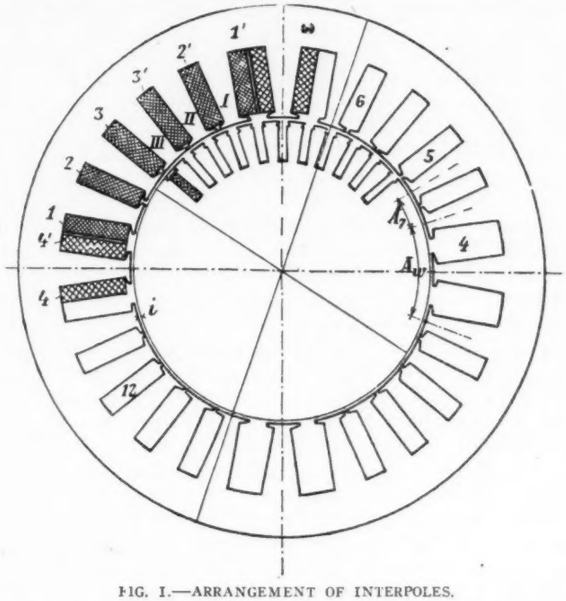


FIG. I.—ARRANGEMENT OF INTERPOLES.

the lamps he is buying are of high-grade quality. A lamp that will run well on a test circuit will also run well on the ordinary working circuit. If lamps are not to be tested in regard to their marked voltage it is obviously impossible to specify anything with regard to their behavior. If by a test one is able to show that certain lamps are of high-grade quality, as a general rule these lamps will be found to give good results when run under ordinary conditions. It is not possible in any other way to specify what a lamp shall do. By testing lamps in a batch under test conditions definite results are obtained which are quite comparable.—Lond. *Elec.*, February 15.

Determining the Horizontal Candle-power of Incandescent Lamps.—UPPENBORN.—A comparison of the following four methods for determining the mean horizontal candle-power of an incandescent lamp. The first method is that of directly measuring the candle-power in a great many different directions, the second is the angular mirror method of the German Association of Electrical Engineers, the third is the analogous method of Siemens & Halske, and the fourth is that of revolving the lamp under test. The main conclusions of the author are that the method of the German Association of Electrical Engineers and that of Siemens & Halske are entirely equivalent and reliable. On the other hand, the method of revolving the incandescent lamp under test in its fixture is very rarely exact, if used in its simplest form; that is, without employing a revolving standard lamp; the error is due to the change of the shape of the filament caused by the rotation. In its improved form, that is, when the standard lamp is also revolved, the method gives correct results only, if the effect of rotation on the standard lamp and on the lamp under test is about the same.—*Elek. Zeit.*, February 14 and 21.

Nernst Filament.—MENDENHALL AND INGERSOLL.—An abstract of a physical paper on an experimental study in which, from a spectrophotometric test of a Nernst filament at several known temperatures the constants in the isochromatic radiation formula were determined on the basis of Wien's law. The normal temperature is given as about 2,300° absolute (or above 2,000° C.). —*Phys. Rev.*, February.

Power.

Gas Power.—DOUGLAS.—A paper read before the Manchester section of the British Inst. Elec. Eng. on large gas power plants. The author emphasizes that gas plants are both reliable and economical and are no longer experimental. After dealing with the practice of gas producers the author concludes by giving the results obtained in a number of works where gas plants have been installed, the figures varying from 1.3 lb. to 1.9 lb. of coal per kw-hour.—Lond. *Elec.*, February 15.

Superheated Steam.—BOLTON.—A discussion of present practice in the use of superheated steam and its advantages. The author emphasizes the necessity of arranging all parts of a steam plant in such a combination as to give the best total effect. In such an arrangement the element of superheat forms an integral part. The author remarks that even at this late date in engine and boiler engineering, in the major number of installations it would be possible to produce, by judicious changes effecting suitable relations of fuel to drafts, to grates, and to flues, greater economies than can be accredited to the mere introduction of superheat to the steam supply.—*Eng. Mag.*, March.

Power Plant.—DIXON.—The concluding article of his long illustrated serial on the planning and construction of power plants. In the present installment he deals with the design and arrangement of the building.—*Eng. Mag.*, March.

Traction.

Steam and Electric Locomotives.—WERNER.—The final arguments for the electrification of a steam railroad are the reduction in operating costs and the increase in earning capacity of the present tracks. There are also additional advantages, consisting in the smaller wear and tear on the tracks, the elimination of smoke, etc., and a greater facility of train movement and greater readiness for service. The author gives the comparative operating costs of a steam trunk line and of the same line operated electrically with the three-phase system. The particular case reported upon is that of the section of a double-track trunk line 78 miles in length. The final comparison is made on the basis of revenue train mile. The cost for each revenue train mile is found to be 36.85 cents for steam locomotives, against 28.94 cents for three-phase electric locomotives. Moreover, there will be a gain due to increased earnings with electric traction, but this cannot be numerically predicted without a careful canvass of local conditions.—*Eng. Mag.*, March.

Single-Phase Road in France.—A note on the first single-phase electric railway to be installed with the Westinghouse system in France. The road runs from Tergnier to Anizy and has a length of about 19 miles. The station will contain two single-phase alternators, each of 300 kw, the frequency being 25 and single-phase current being generated directly at 3,300 volts, which is the voltage of the trolley wire. Motor cars will be used for passenger trains and electric locomotives for freight trains. Each motor car will be equipped with two 40-hp motors. —*L'Eclairage Elec.*, February 23.

Track Construction.—DUBS.—The conclusion of his report on the various methods in use for track construction on interurban electric railways. The author covers mainly the practice in France, and the chief part of the present installment deals with joints.—Lond. *Elec.*, February 15.

Automobiles.—VALBREUZE.—A review of the principles of the different types of petrol-electric automobiles.—*L'Eclairage Elec.*, February 23.

Installations, Systems and Appliances.

London.—PEARSON.—A continuation of his illustrated serial on London central stations. The present installment refers to the municipal station of Poplar Borough, which covers a decidedly industrial area. In the generating station the plant, taken altogether, is capable of developing 3,400 kw, the max-

imum load registered being 2,000 kw. Among the recent extensions are two 1,000-kw Parsons turbo-generators, consuming 17 lb. of steam per kw-hour when working with steam superheated through 100° F. and a 28-in. vacuum. The dynamos are of the revolving-field type, running at 1,500 r.p.m. and generating three-phase currents at 6,000 volts. They have been installed to deal primarily with the power load in the neighborhood of the docks. In conjunction with them at the generating station are two 500-kw La Cour motor-converters. Their alternating-current side is wound to take 6,000 volts from the turbos, while the direct-current side is wound to suit the voltage of the direct-current generating plant. Thus these converters can be practically fully loaded for 24 hours per day, and often dispense with the necessity for running a partly-loaded engine and dynamo. Three similar machines have been installed in sub-stations, while there are, in addition, three batteries of accumulators, each of 600 amp.-hours. All distribution is carried out by means of direct current, the three-phase currents being used solely for transmission. Electric power is used for a great many purposes in the district and much attention has been paid to a vigorous canvass. The increase of the power load and its effect on running costs and standing costs is clearly shown in Fig. 2. The running costs have been brought down from 0.76 d.

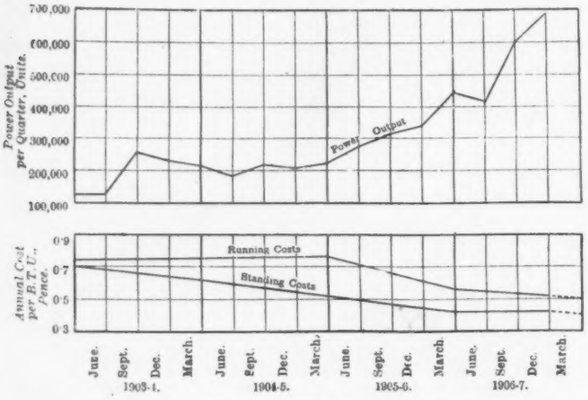


FIG. 2.—POWER COSTS.

(1.52 cent) in March, 1905, to 0.52 d. (1.04 cent) in December, 1906. The standing costs in 1906-7 are affected by an increase of 100 per cent in taxes.—Lond. *Elec.*, February 15.

Electrophysics and Magnetism.

Electron Theory and Radiation.—Schott.—By the electron theory of matter the author understands any theory which assumes matter to consist of electric charges, acting upon each other with electromagnet forces only. He investigates mathematically how such a theory could account for the spectra emitted by the several elements. The chief conclusions of his argument are as follows: After some preliminary notes an ideal radiating system is considered, consisting of a large number of mutually independent similar rings of electrons, each in orbital motion in a suitable controlling field, of which a fraction are ionized owing to the previous expulsion of an electron. Each ion executes a number of vibrations; these can be arranged in six groups according to the frequency (q) relative to the rotating ring; each group includes n classes of vibrations, n being the number of electrons in the ionized ring (ion), and the class (k) giving the number of segments in which the ring vibrates. Each vibrating ion emits a corresponding number of waves, of which the frequencies to a stationary observer are $(q + kw)$, w being the angular velocity of rotation of the ring. The intensities of these waves after the first two or three classes fall off with such great rapidity that waves of classes $+3$ and upwards are far too weak to give rise to observable spectrum lines; waves of classes $+1$ and 0 give rise to lines whose intensities are of the same order of magnitude as those of spectrum lines; waves of classes $+2$ do so when the ionization is large. When the velocity of the electrons in steady motion is very small compared with that of light, there are six frequencies (q) for each class (k); hence, the ring gives at most 18 observable lines. When the velocity is comparable with that of light, the frequency equations are transcendental, and there are an infinite number of frequencies (q) for each class (k); but of these frequencies only six can give rise to observable lines, so that the maximum number for the ring is only 18, as before; that is, too small to account for series or bands.—*Phil. Mag.*, February.

Change of Conductivity of Air.—Gates.—An abstract of a Physical Society paper on the conductivity of the air caused by certain compounds during temperature changes. Investigations of the conductivity of the air, caused by the presence of the sulphate of quinine under certain conditions, indicate that it accompanies hydration and dehydration, although phosphorescent effects to which it may be directly due appear at the same time. The phenomenon is most easily observed during the cooling of the quinine from something over 100° C. to room temperature. During the investigations described in the present paper a large number of substances were heated to about 150° C., and the conductivity of the surrounding gas was tested while they cooled. Of all the substances tested none was found to give so large an effect as that which results from the sulphate of quinine, but a very definite and marked conductivity was found to accompany the cooling of anthracene and to a less degree that of grape sugar and æsculin.—*Phys. Rev.*, February.

Iron Under Small Periodic Magnetizing Forces.—Baldwin.—An investigation of the relations which obtain under actual working conditions between the amplitudes and phases of the different harmonics of the magnetic induction produced in iron, and those of the magnetic intensity producing it, for low values of the induction. From the harmonic expressions obtained for these quantities, the loss of energy in the iron is deduced. Former experiments on the subject have been performed under statical conditions which are seldom realized in practice. The author studied the behavior of specimens of iron in which eddy currents were very small and also those in which they were considerable. The results are given in a number of tables.—*Phil. Mag.*, February.

Magnetic Properties of Heusler Alloys.—McLennan.—An abstract of a Physical Society paper on tests of the magnetostriction and the permeability of Heusler alloys of varying composition. From measurements on the two phenomena the alloys are shown to be in an exceedingly unstable condition when freshly made, and from observed changes in their magnetic behavior the conclusion is drawn that profound modifications are made in their structure through the lapse of time as well as by changes in temperature and by repeated magnetizations and demagnetizations.—*Phys. Rev.*, February.

Alloys of Nickel.—Hill.—An abstract of a Physical Society paper. Many nickel alloys are of great importance. Such are the nickel steels and a number of alloys used as resistance materials. The thermal, mechanical and electric properties seem to be closely connected with the magnetic. These relations may be accounted for by the allotropic theory. An attempt was made by the author without success to apply a formula of Van't Hoff from the theory of solutions to the case of alloys.—*Phys. Rev.*, February.

Electromagnetic Theory.—Nicholson.—A mathematical note on a general solution of the electromagnetic relations. The solution is alternative to that of Lamb.—*Phil. Mag.*, February.

Electron Theory.—De la Rive.—A mathematical note on the introduction of Doppler's factor into the solution of the equations of the electron theory.—*Phil. Mag.*, February.

Electro-Chemistry and Batteries.

Fixation of Atmospheric Nitrogen.—Erlwein.—A paper on the possibilities of utilizing the nitrogen of the air. The author reviews especially the work done by the Siemens & Halske Company in this field and gives a large amount of information on the production of calcium cyanimide, which may either be used directly as a fertilizer or may be worked up into other

marketable chemical products. Considerable information is given concerning possibilities in the latter direction.—*Electrochem and Met. Ind.*, March.

Zinc.—JOHNSON.—A paper on the electrometallurgy of zinc. The author deals with electrostatic and electromagnetic concentrators and discusses how ores formerly useless have thereby become available for economical treatment. He then discusses electrolytic processes, both with fused electrolytes and with aqueous solutions, and thinks that for the treatment of complete lead-zinc ores electrolysis with an alkaline solution is not unpromising. He finally discusses the possibility of the electric furnace and the work which has been done with it in the metallurgy of zinc by different investigators.—*Electrochem. and Met. Ind.*, March.

Electric Smelting.—BENNIE.—A communication with reference to the recent suggestion of Moldenke to use the electric induction furnace in foundry practice. The present author fully agrees with this suggestion and deals with the possibilities of the electric furnace, both in iron and in brass foundries.—*Electrochem. and Met. Ind.*, March.

Electrolysis of Mixtures.—ROSSET.—The first part of a paper on the electrolysis of mixed aqueous solutions. In the present installment the author deals with the nature of the chemical compounds in an aqueous solution and with the phenomenon of hydrolysis.—*L'Eclairage Elec.*, February 16.

Units, Measurements and Instruments.

Deflection Instrument.—NORTHRUP.—A description of an optical device for eliminating the vertical component of the movement of the image of the scale of a suspended instrument like a galvanometer. This device used in conjunction with a well-balanced system enables the scale to be easily read when the system itself is in violent vibration about a horizontal axis. The construction is shown in Fig. 3, where *B* is a side elevation of a D'Arsonval coil fitted with two mirrors, their faces making an angle of 90° with each other. *A* is a front elevation of the same. The course of the ray from the scale to the mirrors and thence to the telescope is shown in the dotted line. It is easily seen that rotation of the 90° mirror system about a horizontal axis does not change the direction of the light ray from the scale to the telescope. Furthermore, if the scale and the telescope are vertically raised or lowered together in an arc of which the mirror is the center the image of the scale continues visible in the telescope. It is therefore very easy "to find the scale" as the necessity for the up-and-down adjustment of telescope and scale when made to move together is dispensed with.—*Phys. Rev.*, February.

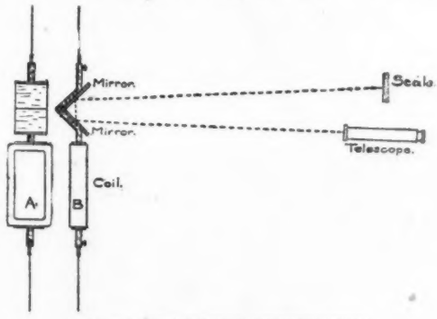


FIG. 3.—DEFLECTION INSTRUMENT.

Standard Cells.—GUTHE AND VON ENDE.—An account of an experimental investigation of both Clark and Weston cells. The chief conclusions are as follows: The electromotive forces of standard cells set up with electrolytic mercurous sulphate by different observers and from different sources agree under otherwise perfectly equal conditions within a few one hundred-thousandths of a volt. Mercury twice distilled in an ordinary vacuum still gives the same results as mercury distilled by Hulett's method. Amalgam prepared in the usual way gives the same results as electrolytic amalgam. Clear and cloudy cadmium sulphate crystals produce no difference in the electromotive force of the cadmium cells. Clark cells with electrolytic, coarsely grained mercurous sulphate immediately after construction have an electromotive force of 1.4204 volts at 25° C. within a few one hundred-thousandths of a volt and remain constant in course of time. The authors have been unable to construct cadmium cells which do not show an identical decrease in electromotive force.—*Phys. Rev.*, February.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—PIERCE.—An account of experiments in which the author determined the wave lengths obtained when two condenser circuits, inductively or directly connected together at a wireless telegraph sending station, are set into oscillation. The author measured the wave length of each of two condenser circuits with each circuit standing alone, and then measured the resultant wave lengths when the two circuits were coupled together after the manner of the electromagnetically coupled and the direct-coupled sending stations of wireless telegraphy. This problem has been studied before theoretically, and the author's extended experimental investigation shows that the theoretical formulas give accurately values of the wave lengths in the electromagnetically connected system, and that the values of the coefficient of coupling required in the equations are accurately enough given by measurements of self and mutual inductance with the comparatively slow frequencies (500 to 1,200 per second) used with an ordinary induction bridge. For direct-connected systems of circuits there is also agreement between theory and measurements, and the wave meter used was found to be correctly calibrated and serviceable for the range of wave lengths between 200 meters and 1,800 meters.—*Phys. Rev.*, February.

High-Frequency Oscillations.—FESSENDEN.—A brief historical résumé of various arc methods for continuously producing high-frequency oscillations, with special reference to the author's own work and to the application of such oscillations to wireless telephony.—Lond. *Elec.*, February 15, 22.

Telephone Receiver.—POINCARÉ.—The first parts of a mathematical paper on the theory of the telephone receiver, based on Maxwell's equations. Since the paper is purely mathematical, it cannot be abstracted.—*L'Eclairage Elec.*, February 16 and 23.

Transmission of Photographs.—KORN.—An article illustrated by diagrams on several improvements of his method of transmitting pictures over an electric transmission line.—*Phys. Zeit.*, February 15.

Electric Light Annunciators.—DRUMMOND.—An illustrated account of electric light signals for the factory intercommunication system used by the Cleveland Twist Drill Company. The possibilities of electric light signals and their advantages over bell signals are pointed out.—*Iron Age*, March 7.

Miscellaneous.

Electric Ignition.—DAVENPORT.—An article on high-tension electric ignition for petrol engines. A series of experiments were carried out in the engineering laboratory of the East London College. The only things allowed to vary were the length of high-tension spark-gap and the voltage; and running in this way two sets of experiments were carried out: one at approximately four volts, and the other at approximately two volts. The author found that an engine designed to run at four volts will run quite as well, or rather better, at two volts. From his tests it seems that standard practice, preferring the higher voltage, is wrong.—Lond. *Eng'ing*, February 22.

Teaching Mathematics.—An editorial on a recent address of Perry on the teaching of mathematics. He called attention to that abuse of figures which is so often found in giving the result of an investigation with far greater accuracy than is really possible. He is now more intent, not so much upon extending the mathematical programme, but upon knocking out the useless parts of it, and thereby making it possible for a student to reach the useful, and, at the same time, higher branches of mathematics more rapidly. Henceforth the elementary calculus and easy differential equations are to be school exercises, and permutations, combinations and probability are to be post-graduate studies.—Lond. *Elec.*, February 15.

BOOK REVIEWS.

Uber Elektronen. By Dr. W. Wien. Leipzig: B. G. Teubner. 28 pages. Price, 1 mark.

The pamphlet contains an address by Dr. W. Wien at the 77th convention of German Naturalists and Physicians, at Meran in 1905. It contains a very interesting historical review of the subject from the standpoint of a physicist. A bibliography of the subject is appended, which greatly adds to the value of the paper.

Elektro-Ingenieur-Kalender, 1907. By A. H. Hirsch and F. Wilking. Berlin: Oscar Coblentz. 330 pages. Price, 2.50 marks.

This little *vade mecum*, prepared for the use of the electrical engineer, contains tables, constants and formulæ frequently needed in the practice of the profession. The wants of the central station with its generators, transformers and prime movers have been well kept in mind as well as the equipment and management of trolley lines and electric railways. Other motors have not been forgotten whether driven by gas, oil or steam. Electrical engineers will find the condensed information of this pocket-book very useful.

Entropy. Thermodynamics from an Engineer's Standpoint, and the Reversibility of Thermodynamics. By James Swinburne. Westminster: Archibald Constable & Co. 137 pages. Price, 4s 6d. net.

Entropy is confessedly one of the contentious subjects of thermodynamics, about which much has been written without affording unqualified satisfaction to the student or a feeling of comfort to the engineer. The mathematician is wont to treat it with an array of symbols upon which he plays with skill and self-satisfaction; but the practical man looks askance at integrals and θ ϕ diagrams, asking himself the while what it all means. An effort is made in this handy volume to say in plain English just what the entropy of a working substance is and also what it is not. Comparisons and numerical examples are given to help in forming a just concept, a physical idea of this elusive thermodynamical elf; and it must be admitted that Mr. Swinburne has succeeded in bringing this quantity out of the haze of uncertainty that surrounded it and given it a clear meaning and a physical basis by which it can be recognized, its properties studied and its action estimated

Looking Forward. By H. W. Hillman. Northampton, Mass.: Valley Forge Publishing Company. 320 pages, 6 illustrations. Price, $1.50.

This interesting and original book is an effort to present the modern ideas and applications of electricity in the form of fiction. The story deals with the phenomenal progress of electricity as evidenced in the year 1912, and the title is borrowed from Edward Bellamy, the author of "Looking Backward," to whom the book is dedicated. Under a very thin veil and slight disguise Mr. Hillman has made a sketch of the great General Electric Works at Schenectady and most of his plot and many of the incidents spring from the environment of the placid Mohawk Valley. In fact, it is safe to assume that Mr. Hillman has drawn upon his own boyish reminiscences for local color, just as he has upon his own experience and accomplishments as an electrical engineer for the various developments of electricity that he brings under notice.

As a novel, the book will not shine, perhaps, among the great fiction of the world, but it is certainly extremely interesting and ingenious in its treatment of electrical conditions and appliances, and in making the events of the story bear a logical relation to the possibilities that electricity puts in the hands of the engineer. Once in a while the effort is made by the ordinary writer of fiction to avail himself of electricity as the *deus ex machina*, and the results are often ludicrous. On the other hand, the electrical events in Mr. Hillman's novel are reasonable and true to life, while his technique is all that could be asked of the most exact scientific writer. It is quite likely that some of the things which we are to enjoy five or six years hence may not come along precisely in the shape given them in "Looking Forward," but there is a certain amount of license allowed the novelist, and after all Mr. Hillman is likely to be as near the facts of 1912 as he is to miss them.

The book is neatly gotten up and printed and the illustrations are excellent, in fact one wishes there were more of them, as there are numerous scenes and adventures in the story that would serve admirably for treatment with the pencil. Mr. Hillman must have spent a large amount of time and trouble over this naive effort in fiction, and we trust he will be rewarded in a substantial manner by the appreciation and cooperation of those whose business it is to promote their own interests by bringing about the general adoption of electricity that Mr. Hillman depicts as having actually occurred within the next decade.

Adjustable Ceiling Incandescent Lamp Fixture

The ceiling fixture shown in the accompanying illustration, known as the "stayright electric fixture," and made by the Stayright Electric Fixture Manufacturing Company, 96 Warren Street, New York, is adjustable both angularly and in

FIGS. 1 AND 2.—ADJUSTABLE CEILING LAMP FIXTURE.

length, and the lamp has also an angular adjustment. As will be seen, one tube telescopes into another and by means of a socket adjustment at the canopy, the fixture can be swung in any direction to throw the rays of light from the lamp directly on the object it is desired to illuminate. The universal joints at the canopy and socket are controlled by friction tension holding the fixture wherever put without the means of any set screw or other device. The tightness or looseness of the swing of the fixture is initially regulated by three screws on the bottom of the canopy. When the length of the fixture is shortened by telescoping, the cord forms a natural coil in the canopy, as shown in Fig. 2. The standard size of fixture is 4 ft. closed and 6 ft. 6 in. extended, but the fixture is also made to meet the needs of any specific case.

Emergency Lighting of Pictures.

The Engineers' Club prior to moving next month from its old home on Fifth Avenue, New York City, to its new house on Bryant Park, decided to give an exhibition of paintings by modern American artists, with the object of making a selection and purchase of some of them. The main dining-room was

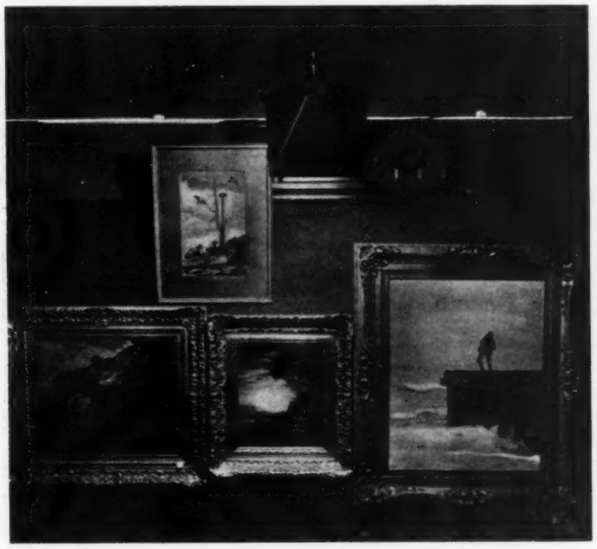


FIG. 1.—TYPE OF ART GALLERY REFLECTOR.

utilized for this purpose, but serious difficulty arose in connection with adequate lighting with incandescent lamps. It was, therefore, decided to adopt the Nernst lamp for the purpose, employing the "Art Gallery" reflectors similar to those used in lighting the Art Galleries at the St. Louis Exposition in 1904. The quality of the light, in its close identity with sunshine, makes it very suitable, and in this instance again the results were certainly beyond all praise. Canvasses were shown by Alden Weir, Ranger, Bunce, Dearth, Paul Dougherty, Childe Hassam, Howe, Davies, Rider, Dessar, Dangerfield and others, and at a special reception given to New York artists these gentlemen were all most enthusiastic as to the manner in which the lighting brought out the real colors, tones and "values" of their work.

The alternating-current service was employed, the club being connected to the mains of the United Electric Light & Power Company. Sixteen two-glower lamps were installed and the lamps were suspended four feet from each picture, and about six to seven feet on centers. This was found to give a perfectly diffused light of sufficient intensity to make a most satisfactory illumination. Mr. F. W. Smith, the secretary of the United Company, and Mr. C. A. Barton, of the Nernst Lamp Company, both members of the club, co-operated actively with the art committee in making the installation a success; and it is said that a better exhibition of its size and kind—some thirty pictures—was never given with better lighting, in New York City. In its new home the club will have a fine large club room available for such purposes, and at the first exhibition in that house it is proposed to employ the same lighting methods.

Economical Increase of Lighting Network

Belleville, Ill., having some 20,000 inhabitants, possesses a greater number of manufacturing industries of various kinds, especially foundries, than is usual for a town of its population. The Belleville Gas & Electric Company, which has been supplying both light and power for these factories for several years, for a long time maintained a 500-volt direct-current service which, it was found, required considerable expenditure for feed wire copper in order to extend and enlarge its service to take care of new factories scattered along the rights-of-way of several railroads passing through Belleville.

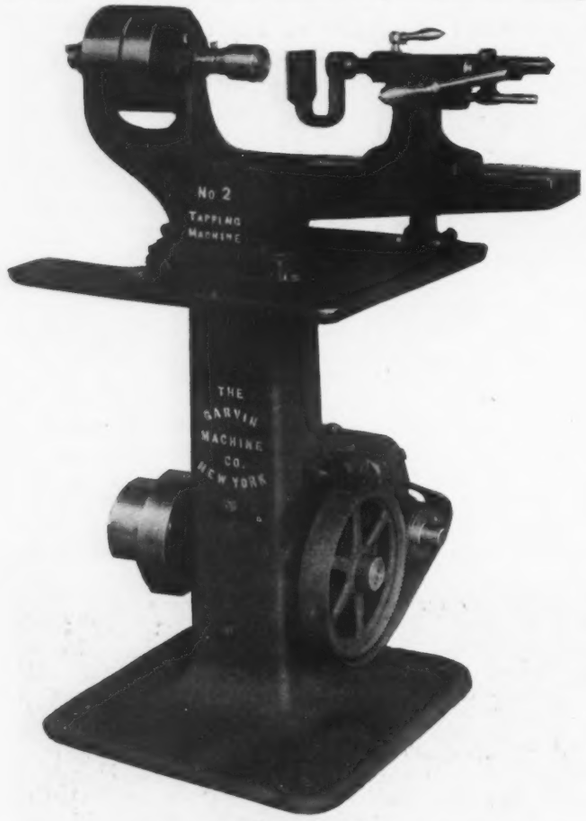
A means of overcoming this difficulty was presented in the alternative of supplying power from single-phase lighting circuits or of installing a polyphase distributing system for power purposes. The use of a single-phase system was adopted and an Allis-Chalmers Corliss engine direct-connected to an Allis-Chalmers single-phase generator was the equipment selected to solve the difficulty. The generator is a 550-kw, 2,300-volt, 60-cycle machine and the engine is one of the well-known Reynolds-Corliss type, 30 in. by 48 in.

While a considerable portion of the present output is through a 500-volt, direct-current generator, the 500-volt system is not being extended. All new business is taken on the single-phase, alternating-current circuits, and some business has even been changed from 500 volts direct current to single-phase, alternating current, because of better voltage regulation on the alternating-current circuits. Out of a connected load of about 900 hp, 500 is in direct-current motors.

FIG. 2.—LIGHTING OF ART EXHIBITION, ENGINEERS' CLUB, NEW YORK.

Horizontal Tapping Machine.

The accompanying illustration shows a horizontal tapping machine driven by a ½-hp electric motor, the speed of the latter being 1,800 r.p.m. The machine is suitable for tapping holes from 3/16 to ½ in. in diameter. The head stock is solid with the bed and fitted with cap bearings in which run the hubs of the driving pulleys, so that the spindle is freed from the wear and pressure of the belt. The spindle is driven by a positive clutch working between the two pulleys, and is fitted with an adjustable collar to provide for tapping very shallow holes and a universal three-jaw chuck for holding taps. The tall spindle has a movement of 2 in. by lever and is provided with a binder and an adjustable stop collar. The work pad is removable, and the spindle is fitted with a taper hole to receive tools, so that the machine may be used for drilling



TAPPING MACHINE.

purposes. The weight of the machine is 400 lbs.; the greatest distance between the chuck and work plate is 12⅜ in., and the swing over bed, 11 in. This machine is made by the Garvin Machine Company, New York.

Application of the Rateau Process for the Utilization of Exhaust Steam.

The first application in America of the Rateau process for the utilization of exhaust steam from intermittently running engines has been put in operation at the steel works of the International Harvester Company, South Chicago, Ill. The exhaust steam from a reversible blooming mill is utilized in a low-pressure Rateau turbine of 600 kw capacity, direct-connected to two direct-current, 250-volt generators. In view of regulating the intermittent exhaust of steam, the exhaust of the blooming mill is worked through one of the water-type Rateau steam regenerators, which has a capacity sufficient to take care of intermissions of several minutes' duration in the running of the main engine. The steam then feeds the low-pressure turbine and is condensed in a barometric condenser.

The pressures are atmospheric pressure absolute at the inlet of the turbine and 28-in. vacuum at the outlet. The quantity of steam available from the main engine is more than twice the amount needed by the turbine. In order to avoid back pressure on the engine a 24-in. relief valve exhausts direct to atmosphere when the pressure has a tendency to increase.

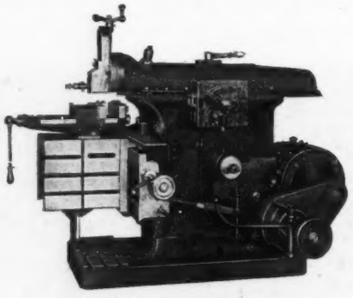
In case of a shut-down of the main engine for a long period of time an automatic reducing valve allows the steam from the boilers to be directed and utilized in the low-pressure turbine.

This process shows that in the exhaust of an average size reversible blooming mill there is enough available power to run from 1,000 to 1,500 kw, the only expense being interest on the investment and condensing water.

Mr. A. Leonhauser, engineer of the International Harvester Works, in collaboration with Mr. C. H. Smoot, of the Rateau Company, designed the entire plant. The turbine and dynamos were manufactured by the Western Electric Company in its Hawthorne shops, under the drawings, specifications and supervision of the Rateau Turbine Company. The barometric condenser and air pump were furnished by the Alberger Condenser Company, of New York. The steam regenerator, designed by the Rateau Steam Regenerator Company, was built by John Mohr & Sons, of Chicago. The piping was furnished by the Best Manufacturing Company, of Pittsburg. The whole plant was contracted for and put in operation by the Rateau Steam Regenerator Company, 215 Wabash Avenue, Chicago, which handles the exclusive rights in America for the steam regenerators.

Motor Driven Shaper.

The illustration herewith shows a very interesting application of a General Electric direct-current motor to a high speed, quick stroke, 24-in. shaper recently manufactured by Gould & Eberhardt, of Newark, N. J., for the National Tube



MOTOR-DRIVEN SHAPER.

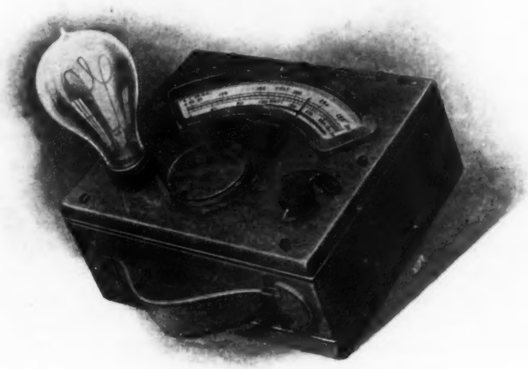
Company, Lorain, O. The motor is mounted on the back of the main column of the shaper, thus making it integral with the tool, and at the same time keeping it where it will be protected from dirt or sweepings. The compact cylindrical construction of the motor adapts it to the machine so that a symmetrical unit results. Power is transmitted to the main shaft of the shaper through a Morse silent chain.

One of the special features in this electrically-driven tool is found in the fact that the motor is not stopped and started each time that the tool itself is stopped or started. The motor may run continuously, and by means of the long, curved lever shown at the right, a clutch is thrown in or out, as occasion requires, thus giving perfect control of the cutting head without the strain or shock involved in starting and stopping the motor instantaneously.

A very desirable feature in connection with the clutch is the mechanical brake which enables the cutting head to be brought to rest almost instantly during any portion of the stroke. The arrangement for governing the transverse feed of the table is ingenious and effective, as is also the method supporting the table on the extended base when heavy work is being machined.

Portable Volt-Wattmeter.

The instrument illustrated herewith combines in one both a voltmeter and a wattmeter and is especially suited for the testing of lamps and accessories by central station companies. The instrument is provided with a switch having two pointers: one for 150-volt circuits and the other for 300-volt circuits. Each pointer travels over an arc which has three stopping points, the first reading "volts," the second "watts" and the third "off."



COMBINATION PORTABLE VOLT-WATTMETER.

In the socket arranged on the top of the cars can be placed a lamp or an attachment plug connected with the device under test. In addition to the testing of lamps the instrument is useful for testing small motors, water heaters and coffee percolators, and it may conveniently be employed for determining the core loss in transformers for capacities up to and including 30 kw.

A manufacturer of lamps or small electricity consuming devices who makes meritorious products will find the volt-wattmeter very convenient, because the use of this instrument by his salesman in addition to showing up the good points of his own apparatus, serves to accentuate the deficiency of inferior types.

The instrument is made by the Wagner Electric Manufacturing Company, St. Louis, Mo.

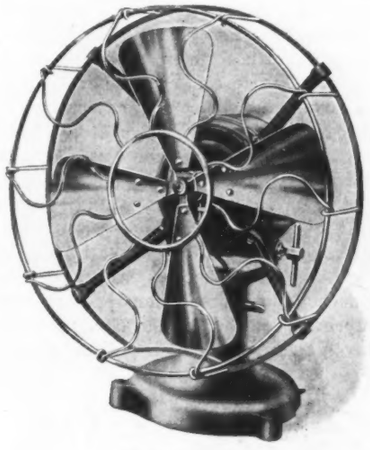
Voltmeters for U. S. Signal Corps.

The United States Signal Corps issued a specification calling for twenty-four post testing voltmeters to be used in cable testing. These instruments were to be standard in size, dead-beat, with equally divided scales, and to give full scale deflection on 60 volts with 100,000 ohms resistance, the resistance to be self-contained in the instrument and the instrument to be provided with a key for throwing in and out of circuit. They specified that the instruments must be accurate within ½ of 1 per cent. The makers, however, guaranteed an accuracy of ¼ of 1 per cent. These instruments were carefully inspected at the works of the Keystone Electrical Instrument Company, Philadelphia, by the electrical engineer for the Signal Corps, were accepted, certified and paid for.

The particular interest in this order lies in the high resistance called for. It meant the construction of a commercial instrument, with pivoted moving coil, having a resistance of 1.667 ohms per volt, which meant that the makers had but 1/1667 of an ampere at their disposal for full scale deflection of 90°. It was, it is believed, the most sensitive instrument put into commercial use in the shape of a calibrated instrument with pivoted moving coil, and was constructed on the well-known Deprez-d'Arsonval principle. Only a few years ago such a sensibility would have been considered good for a reflecting galvanometer, and it seems to show the advance in the art of electrical measuring instruments when such a sensibility can be achieved in a direct-reading voltmeter.

Peerless Fans.

In the Peerless fan motor for 1907 a number of the parts have been brought to a further degree of efficiency through changes in detail design. All swivel and trunnion desk fans are instantly convertible into bracket fans by merely adjusting a single thumb-screw at the trunnion. A more positive device has been adopted for catching any oil that happens to escape from the

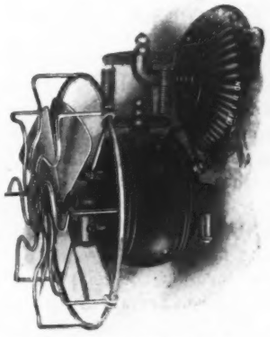


PEERLESS FAN.

bearings. Close attention is given to the finish, japanning, polishing and lacquering. The interior of the motors is also japanned, thus precluding rust and also providing an insulation. An alteration in the switch at the top of the ceiling fan makes it well-nigh impossible for lead wires to be broken off. These latter fans have also been redesigned for increased speed, to meet the demand in that direction. The oscillating desk fan is now designed to reverse against an air cushion that does away with all jar. Various other details of the mechanism of this have been improved.

Diehl Telephone Booth Fan.

The Diehl Manufacturing Company has added to its long line of fans a type for use in the telephone booth, as shown in the accompanying illustration. The construction of the motor is the same as that of the Diehl Universal fan motor, but the adjustable features of the latter are replaced by suspension



TELEPHONE BOOTH FAN.

springs, as illustrated in the cut. By this means any vibration from the moving parts of the motor or other cause is not communicated to the motor support, with the result that there is absolutely no noise in operation. The speed of the motor is also greatly reduced to eliminate any noise due to the movement of air. In addition the small size of the rooms in which they are commonly used renders unnecessary and undesirable the stronger air current produced by the motor running at normal speed.

General Electric Fan Motors for 1907.

The General Electric Company presents, as usual, a complete line of fan motors. Desk fans are furnished in all different types for standard voltages and frequencies or are wound special to order. Both direct and alternating-current fans of the desk type are made with 12-in. or 16-in. blades. These with the bracket type fans of the same design and sizes are available for all classes of service. In addition to the ordinary uses for cooling, office desk or domestic ventilation during the summer months, they will keep the frost from the storekeeper's window or supply air currents for advertising novelties of various kinds.

In a store on a windy street an odd use of a fan of the desk type was recently noticed. The customer's entrance to the shop was accompanied by a stiff breeze which badly disarranged the nearby counters. A large fan motor was mounted opposite the door so that the force of the air counteracted the entering breeze, the door by this method being opened in comparative calm.

Combining the compact and efficient general design of the desk and wall bracket types of fan motors, with special mountings, are the telephone booth ventilating fans and the exhaust fans. The spring suspension of the former eliminates vibration in the telephone booth and makes what is ordinarily a turkish bath

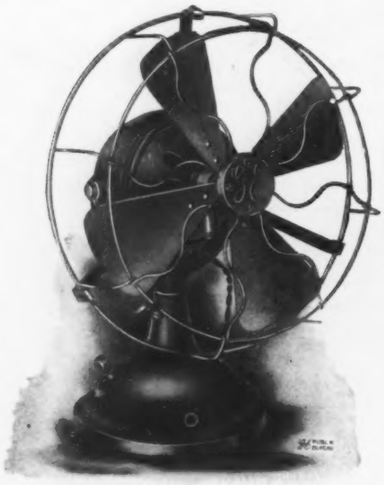


FIG. 1.—DIRECT-CURRENT DESK FAN.

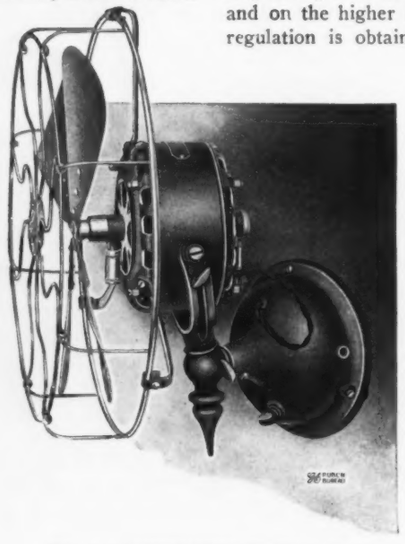


FIG. 2.—ALTERNATING-CURRENT WALL BRACKET FAN.

cabinet more bearable in summer. This fan is made for both alternating and direct current at commercial voltages and frequencies. The illustration of the exhaust fans indicate the method of mounting these. This type of fan is useful in both private and public kitchens, in restaurants, lavatories and stores where a permanent method of ventilation is desirable.

Quite recently the use of the fan motor in the cold air pipe of the hot air furnace has been exploited, as an economical addition to this heating system. The square frames of the exhaust fan types might readily be adopted for this purpose and a permanent installation be made.

The broad wooden blades of the ceiling fan suit them, especially for the cooling of large areas without disagreeable drafts The fan blades are 52 in. in diameter for alternating-current fans and 56 and 58 in. in diameter for the direct-current motors. All have four blades and are made in plain or in ornamental designs. The alternating-current ceiling fans have two or three speeds, while the 58-in. blade direct-current fan can be operated at three speeds and the 56-in. blade direct-current fan at a single speed. The motors are wound for all commercial voltages and frequencies.

For soda fountains, public dining tables, etc., a combination column fan and electrolier forms an artistic fixture. Such a fan is shown in Fig. 3. The motor is designed for alternating current and a 52-in., four-blade fan is used.

Mention has been made of various speeds of fans. This

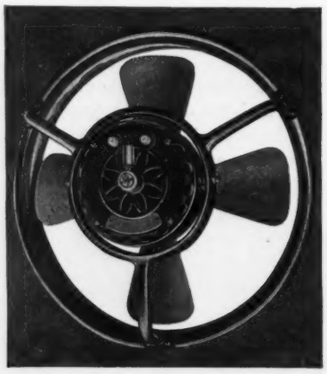


FIG. 4.—ALTERNATING-CURRENT EXHAUST FAN.

speed variation, in alternating-current motors, is obtained by a six-point reactive coil and switch. In this way the desk or wall bracket type is of well-nigh universal application, since it may be operated on slow speeds for the office desk or home and on the higher speeds for stores and halls. Similar speed regulation is obtained in the direct-current type of desk and

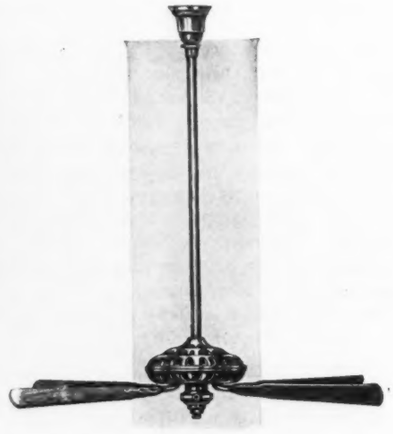


FIG. 3.—ALTERNATING-CURRENT CEILING FAN.

wall bracket fans by a self-contained four-point switch and indestructible resistance, giving three speeds.

Robbins & Myers Exhaust Fans.

As the value of good ventilation becomes generally appreciated there is an increasing demand for exhaust fans suitable for ventilating small rooms, hallways, closets and small apartments. To meet this demand the exhaust fan illustrated in Fig. 1 was placed on the market during last season in a limited way, and is now being manufactured in very large numbers. The apparatus consists of small direct-current motors in several sizes, two of which, with 12-in. and 16-in. blades, are considered standard. On these motors are brass-plated propeller type fans, and the motor and fan are, as shown in the cuts, mounted in brackets in wall rings, to serve as exhaust fans. They are rather more ornamental and of much higher degree of finish than the ordinary exhaust fan, so as to be better suited for use in the ordinary class of interiors. The brass parts are usually highly lacquered and polished, and the motors and mounting rings are finished in black enamel.

There are many classes of service where it is desirable to have the air in a compartment kept in circulation, so as to

maintain uniform conditions of temperature or humidity, such for instance as laundry dry houses. For this purpose the fan shown in Fig. 2 has been developed. It consists of a very powerful ceiling fan type motor mounted on a tripod with the

FIG. 1.—EXHAUST FAN.

shaft projecting some distance below the bottom of the feet. The motor is intended to be mounted on top of the roof of an open or dry room, with the shaft passing through the roof, and the blades mounted just below the ceiling, inside. All parts of the apparatus are designed in proportion with the idea of being self-contained and running for long periods with no attention whatever. The same system of lubrication is employed

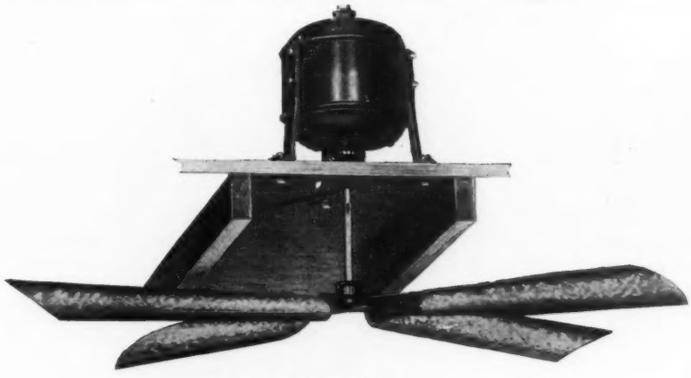


FIG. 2.—CEILING FAN.

in these fans as that which has been used in the regular "The Standard" ceiling fans of the same manufacturers for many years.

The fans above described are the most important additions to the line of fans which the Robbins & Myers Co., of Springfield, Ohio, has been marketing under the name of "The Standard" fans for the last ten years.

Lundell Fans.

The Lundell direct-current fan motors, manufactured by the Sprague Electric Company, have been improved for the season of 1907, with a view to embodying in one fan all the features of the solid base desk, the swivel and trunnion desk, and the swivel and trunnion bracket types. This has been accomplished by dispensing with the usual swivel and trunnion arrangement and substituting therefor a universal joint as a connection between motor and base, which enables the fan to be used interchangeably as desk or bracket type. This construction presents obvious advantages to both dealer and user.

In addition to the new universal joint, other improvements are incorporated in the 1907 fan motor. The guard has been greatly strengthened by more rigid bracing and by the adoption of heavy rectangular wire for the guard ring. Improvements have also been made in such details of construction as bearings, arrangement of switch and switch handle, etc., all of

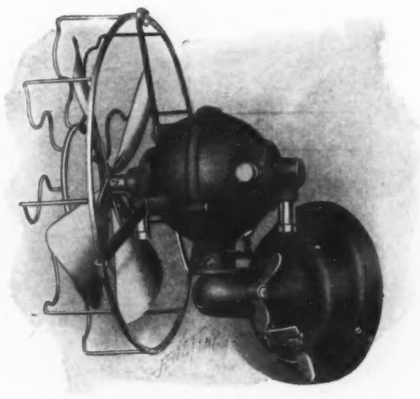


FIG. 1.—LUNDELL BRACKET FAN.

which will make this fan even more reliable than previous Sprague models, which have always been the best. The aim

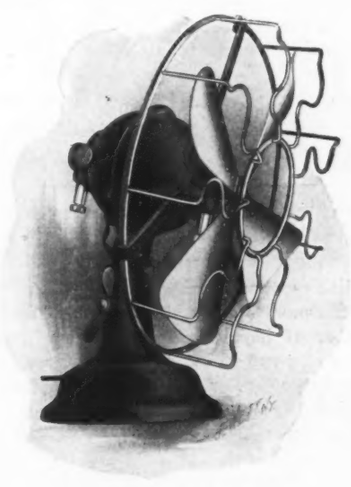


FIG. 2.—LUNDELL DESK FAN.

of the manufacturers has been to produce a fan on whose reliability and lasting qualities absolute dependence can be placed, and they claim that the Sprague universal fan attains these ideals.

Disc Ventilating Fans.

The accompanying illustrations show two types of ventilating fans made by the American Blower Company, Detroit, Mich.

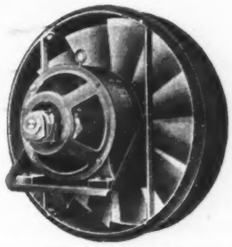


FIG. 1.—DISC VENTILATING FAN.

As will be seen, in one case the motor is mounted on a substantial base and in the other is supported by a steel saddle.

It is claimed that these methods of mounting are superior to that in which the motor is attached to the arms of the fan. Each fan is composed of 12 steel blades, each overlapping the adjacent ones. It has been found that this large number of blades and their particular form assures a maximum delivery of air, while

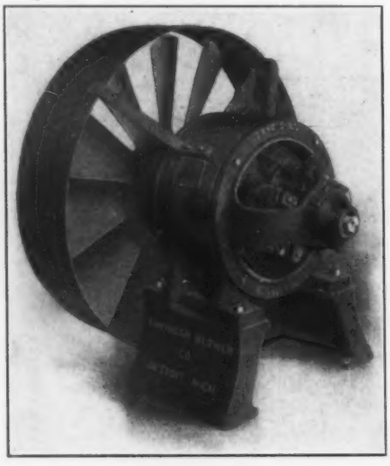


FIG. 2.—DISC VENTILATING FAN.

the central disc prevents backflow of air. The fans are made in sizes from 18 in diameter to 60 inches, and of medium and high speed. The 18-in. size has a speed of 900 or 1,400 r.p.m., in the former case consuming ¼ hp and in the latter case ½ hp. The corresponding figures for the 60-in. fan are 300 and 400 r.p.m. and 2.85 and 7.25 hp.

Emerson Fan Motors.

The 1907 line of Emerson alternating-current desk and ceiling types of fan motors differ but little from those of last year, when a number of important improvements were introduced. As in previous years, the fans are manufactured in two grades: "Emerson" and "Trojan," the latter being intended for service not necessitating all of the refinements embodied in the "Emerson" fan. The latter are equipped with a patent blade giving

EMERSON WALL BRACKET FAN.

the best distribution of air with the least hum and have a hardened steel shaft and oil-tight bearing. Both lines have a convertible bracket base permitting the desk fans to be changed into bracket fans without extra parts, which feature was introduced last year. For high-frequency alternating current there is a five-blade, single-speed ceiling fan; other types have a two-speed porcelain mounted switch in the base. The desk fans for medium speed at 60 cycles have an improved form of field winding and an automatic starting device which insures a prompt start and low current consumption on either speed.

Westinghouse Fan Motors.

The line of Westinghouse fans for 1907 incorporates the good features of previous years, together with a number of improvements, still further increasing their efficiency and effectiveness. The accompanying illustrations show the alternating-

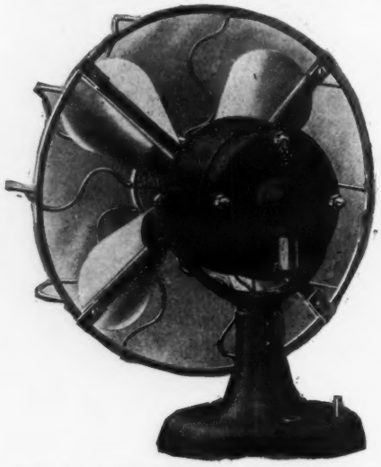


FIG. 1.—ALTERNATING-CURRENT DESK FAN.

current and direct-current desk fans. The former are made for frequencies from 25 to 133 and for voltages of 100-115 and 200-230, the size of blades being from 12 in. to 16 in. For all frequencies from 25 to 133 there are two speeds except for 40 to 50-cycle circuits, in which case there is a single speed. The higher speed ranges from about 1,300 r.p.m. for low frequencies

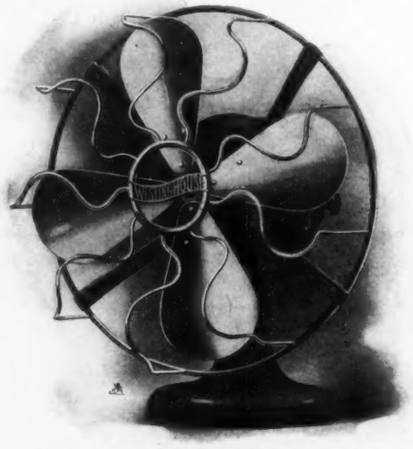


FIG. 2.—DIRECT-CURRENT DESK FAN.

to 1,600 r.p.m. for high frequencies, the corresponding lower speeds being 1,150 and 1,200. The direct-current fans are made in two sizes, 12 and 16-in., for the same voltages as the alternating-current type. The direct-current type, however, has three speeds, the lower being 1,000 r.p.m., the second speed 1,300 r.p.m., and the third speed 1,600 to 1,650 r.p.m.

Buffalo Electric and Hand Forge Blower.

Electrically-driven forge blowers are not what may be termed an innovation for their use has become common in the larger forge shops and small sizes have been economically employed by the smiths and horseshoers having a large amount of light work to handle, not because of convenience, but as a money saver. The electric blower can be placed where most convenient without regard to line shafts or other shop arrangements, and it has been found that its installation saves practically all the time of one helper and, of course, only consumes power in direct proportion to the amount of air delivered.

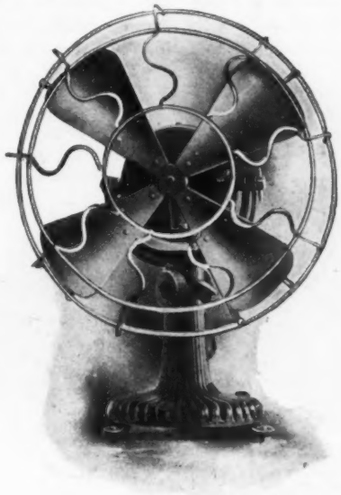
For small shops on country circuits one complaint has formerly been that the supply of current could not be depended upon with absolute certainty, and that two blowers, one power-driven and one hand-driven, were desirable to insure against emergencies. To meet the demand the Buffalo Forge Company, of Buffalo, New York, has just placed on the market a combination electric and hand blower, consisting of a Buffalo forge with an electric motor mounted on a small platform contained within the tripod legs of the machine. This places the motor in an out-of-the-way, yet readily accessible, position. The fan spindle is continued through the dust proof oil case containing the gearing for the hand drive, and terminates in a small pulley which connects with the motor by means of a round belt.

The motors usually supplied are either 104-volt, 60-cycle induction type for alternating current, or for 110-volt, direct-current, and are attachable by lamp cord to an ordinary 16-cp lamp socket as a source of power. If at any time it is desired to run the blower by hand, the belt is removed and the machine becomes at once an easy-running, powerful blast blower. The power for the hand drive passes through only two sets of helical and spur cut gears finished on special machines, and running in an oil bath with attendant minimum loss by friction. All bearings are bored and reamed in the solid metal, no liners being used. All machine work is done on jigs and the parts are interchangeable. The outlet of the fan casing may be turned at any angle desired, and the gear and fan case are also adjustable as to height. The blower is furnished with blast piping, air-gate and side and center blast tuyere.

The applications of the electric-driven hand blowers are not confined to forge fires, however, as they are suitable for use in systems for drawing out smoke or fumes through piping where exhaust fans are not suitable, furnishing air at moderate pressure up to 1 or 2 ounces through short piping systems, etc.

Fidelity Fans.

The fans for the present year made by the Fidelity Electric Company, of Lancaster, Pa., are of the combination type, which enables them to be used indifferently as desk and bracket fans. The new type is a swivel and trunnion fan, as shown in the illustration, and the hole in the base at right angles to a hole engaging the swivel arm enables the fan to be transformed into a bracket fan as well. The motor of this fan is of the enclosed type of bipolar construction, which has been generally adopted as being the most efficient, satisfactory and durable for desk fans.



FIDELITY COMBINATION FAN.

Sturtevant Steel Plate Electric Fans.

The accompanying illustrations show two electric fans made by the B. F. Sturtevant Company, Hyde Park, Mass., for purposes of ventilation and also for application to mechanical draft.

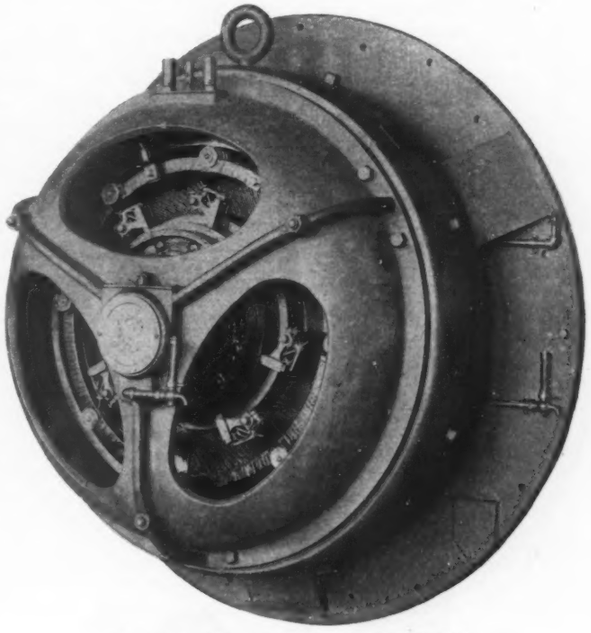


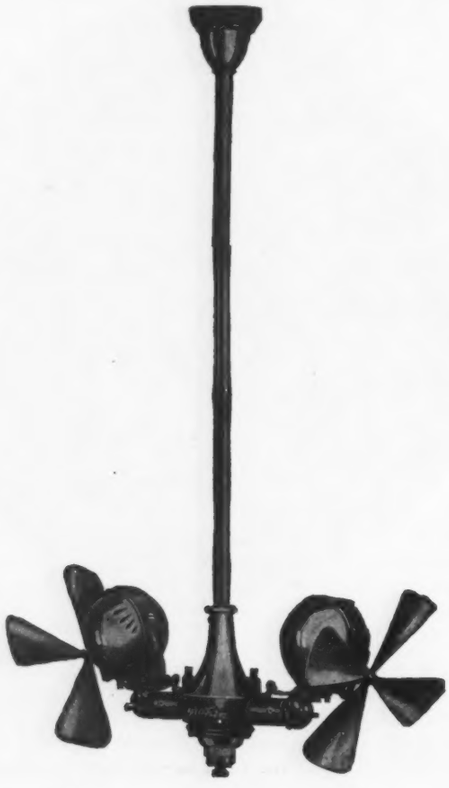
FIG. 1.—MOTOR FOR ATTACHMENT TO FAN.

Fig. 1 shows an eight-pole fan motor for attachment to the case of a fan, and Fig. 2 illustrates a type for bolting directly to the wall, a four-pole motor being used in this case. In each case the motor has been specially designed for fan service. The enclosed feature of the latter motor renders it serviceable for use where the air is constantly drawn across their surfaces. The motors are wound for 150, 250 or 500-volt circuits. The speed ranges from 1,000 r.p.m. for an 18-in. size of fan to 115 r.p.m. for a type which has a fan 10 ft. in diameter. Each fan is fitted with a speed controller giving a medium and a maximum speed.

FIG. 2.—FAN COMPLETE.

Jandus Fans.

Among the improvements in Jandus fans is a new type of "gyrofan" having 15-in. motors mounted on a newly designed fixture. The "gyrofan," it will be recalled, is a ceiling or column type in which two fan motors are mounted on the extremities



"GYROFAN."

of a revolvable bracket to which motion is given about its vertical axis by the reaction of the fan blades to the air they set in motion. The Jandus alternating and direct-current desk and bracket fans are now all made of the combination type which enables a fan to be quickly transformed from the desk to bracket type, or vice versa.

Colonial Fans.

The Colonial fans for 1907 are of the same design as heretofore, no material changes having been indicated as necessary. As the result of elaborate tests, some minor changes have been made which improve the fan in many respects. The speed has been increased without increasing the current consumption. The desk fan oil cup is now made in one piece, making it easier to fill and adjust. The ceiling fan switch has been improved, and is now so constructed as to make it impossible for the feed wires to come loose or be twisted off. The Colonial oscillator has been entirely remodeled and extended, and severe tests have shown the new form to be a great improvement.

Century Ceiling Fan.

The 1907 type of Century ceiling fan, made by the Century Electric Company, St. Louis, contains a number of improvements over preceding types, which have been introduced to increase further the efficiency of operation and durability. The shaft revolves on hardened steel ball bearings immersed in oil, the construction being such as to prevent the possibility of oil being thrown. The fan is regularly made for frequencies from

CENTURY CEILING FAN.

50 to 67 cycles. At 60 cycles the fan has a maximum speed of 225 r.p.m. and a second speed of 180 r.p.m. can be obtained by means of a two-speed switch. The sweep of the blade is 58 in.

Bates Fans.

The improvements introduced into the fans made by the D. L. Bates & Bro. Company, Dayton, O., are mainly in minor details, securing still further economy and durability of operation, the main design of the type having been perfected through many years of experience in the past. The convertible desk bracket fan has a bi-polar motor with three speeds and the motor of the ceiling type has six poles with either a single or two-speed switch. The blades of the desk fans continue to be of generous size—no less than 20 ins. in diameter.

Watson Ventilating Fans.

The accompanying illustration shows a type of ventilating fan made by the Mechanical Appliance Company, Milwaukee, Wis. The fan proper is made either with straight or curved blades, and in diameters from 18 to 42 in. The motors are made either

VENTILATING FAN.

semi-enclosed or fully enclosed. The outfit comprises an automatic release speed controller. The brush-holders are of polished aluminum, and permit of convenient adjustment and renewal of brushes.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Continued improvement in conditions which affect trade were noted during the week, also in the traffic situation, which had the effect of increasing the distribution of merchandise. Country buyers are present at the principal business centers in large numbers, and the volume of house business done is of excellent proportions, exceeding in some lines even that of a year ago, when business was exceptionally brisk. A few trade reports tell of conservatism regarding operations for the future, due to high prices and tight money, but there is practical unanimity as to the activity of current trade, comparisons with last year's figures being almost always decidedly favorable. Several wage scales are under discussion that may not be settled without further enhancing the cost of production or operation, but no serious strike is anticipated, and higher freight rates have become necessary on some roads because of increased expenses. As regards manufacturing lines, it is the old story of heavily filled order books and of capacity being worked to the utmost, despite which deliveries are backward. Collections, though satisfactory in some lines, are, on the whole, very backward, the tightness of money and the enormous volume of business outstanding being the main factors. Business failures are down to a low point, the number reported by *Bradstreet's* for the week ending March 7 being 172, against 194 in the week previous and 177 in the corresponding week last year. Business in foundry pig iron, taking the country as a whole, is of fair proportions. Within the week the leading interest bought 5,000 tons of Bessemer pig for delivery this month, the price being $22, valley furnace. There is still a scarcity of steel billets, a leading concern finding it necessary to purchase 5,000 tons from a new Eastern plant, but on the other hand prices are off 50 cents a ton at Pittsburg. A sale of some 6,000 tons of sheet bars for export the last quarter of the year is reported, and further negotiations are said to be under way. Activity prevails in finished lines. Practically all the lighter lines fetch premiums where fairly prompt delivery is demanded. Copper was dull but higher, and at the close of the week the market reflected stronger pressure for prompt delivery of lake, electrolytic and casting copper. Lake was sold at 26c. to 26½c. for April, May and June. Electrolytic for the same months was at 25½c. to 25⅞c. Prime casting copper, 60 days, was 25c. to 25¼c. One corporation sold 15,000,000 lbs. of prime lake during the week at 26c. to 26½c.; has almost closed out for May and has none for earlier delivery. Another lake producer sold several carloads of prime lake at 26⅜c. for April shipment. The principal domestic copper consumers express the opinion that present levels of prices will rule through the year. They do not anticipate any change in conditions which will warrant higher or lower prices.

TURBINES FOR MASSENA.—I. P. Morris Company, Port Richmond Iron Works, Philadelphia, Pa., has received the contract to furnish the Aluminum Company of America with 12 turbines with a maximum capacity of 24,000 hp. These turbines will be installed in its plant at Massena, N. Y., on the St. Lawrence. There are four 6,000-hp units in all, each unit consisting of three separate turbines on one shaft and each turbine consisting of two runners, discharging into a common draught chest. The turbines will be located in an open flume and operate under a head of 30 ft. and run at a speed of 140 r.p.m. It has also received the contract to furnish the McCall Ferry Power Company, at McCall Ferry, Pa., six 13,500-hp turbines of the vertical shaft Francis inward flow type. These units operate under an average head of 53 ft. and run at a speed of 94 r.p.m. These turbines along with the four 13,000-hp wheels, which the I. P. Morris Company is now installing in the plant of the Electrical Development Company of Ontario are the largest turbines in the world.

LARGE TELEPHONE EXPENDITURES.—That large sums are being invested in the telephone business in Indiana is evidenced by the improvements now being made. New and costly exchange buildings are being erected in Indianapolis by the Central Union Telephone Company and the Indianapolis Telephone Company, the Richmond Home Telephone Company, the Lafayette Telephone Company, the Wabash Home Telephone Company, the Rushville Co-operative Telephone Company and the Citizens' Telephone Company, of Columbus. In each of these new exchange buildings new and up-to-date switchboards and equipments will be installed this spring. In addition to the above the New Long-Distance Telephone Company is completing 600 miles of copper metallic toll lines and the American Telegraph & Telephone Company has almost completed 300 miles of toll line between New Albany, Terre Haute and Bloomington, while the South Bend Home Telephone Company is constructing a new independent trunk line by way of Plymouth to Logansport.

NEW GENERAL ELECTRIC WORKS.—Rumors have been current for some time as to the establishment of new factories by the General Electric Company in Pennsylvania, and it is now announced that large shops are to be erected by the General Electric Company at Erie, Pa., on about 700 acres of land east of the city, extending from the Lake Shore Railroad to the lake front. Arrangements for acquiring the site have been completed and plans have already been completed for the works. The present rate of the growth of business of the company requires the provision of additional manufacturing facilities each year, which will employ between 4,000 and 5,000 additional hands. The present plants will not be affected by the new one. About 400 acres of the site will be set aside for residences of employes. It is the intention of the company to have comfortable and attractive homes built.

WESTINGHOUSE IN EUROPE.—It is stated that the French Westinghouse Company has closed a contract for the electrification of an important portion of the Italian State Railways, namely, the main trunk line between Genoa and Milan, the contract calling for locomotives and electric equipment aggregating over 5,000,000 francs. The business of the French Westinghouse Company for the year ending December 31 aggregated 10,000,000 francs, while this year the orders received in the electric and brake departments are almost double those for the same period in 1906, without the contract with the Italian government. In addition to the electrical and brake branches of the business, the company has now begun the sale of the LeBlanc condensing apparatus, under exclusive rights, in connection with the operation of steam engines.

PHILADELPHIA ELECTRIC COMPANY.—It has recently been stated in some of the papers that the Philadelphia Electric Company is about to build a large power house at Thirteenth Street and Washington Avenue. This is in error. The land which has been bought is only 1½ miles from the present River Front station, where the company has about 11 acres of land, which it hopes and proposes to cover ultimately with one of the largest generating plants in the world. The building, which is actually to be erected at Thirteenth Street is a store house for the General Electric Company, and the Philadelphia papers have made a mistake in identity.

GEORGIA WATER POWER.—The Anthony Shoals Power Company, of Washington, Ga., having purchased large water power properties near that place, has increased its capital stock to $5,000,000, and will build a 30-ft. dam across Broad River to develop electric energy. It is estimated that 45,000 hp will be controlled by the company. J. A. Fitzpatrick is president of the company.

HAVANA CABLE ORDERED.—The contract for the deep sea submarine cable from New York City to Havana for the Commercial Cable Company has been awarded to the India Rubber, Gutta Percha & Telegraph Works Company, Limited, of London. The cable is to be in operation by September next and the work of manufacture has already begun.

APPARATUS WANTED.—The White Hall Sewer Pipe & Stoneware Company, White Hall, Ill., is in the market for a good engine and generator, direct-connected unit, 200-kw, direct-current, 500 volt, in first-class condition.

FOOTE, PIERSON & CO., of New York City, have issued the following notice to the trade: "We beg to announce that on or about April 15 we will move our business from No. 82 and 84 Fulton Street, where we have been located for the past twenty-three years, to No. 160 and 162 Duane Street, corner Hudson Street, where we will occupy the entire five floors. We have been compelled to make this move owing to the rapid increase in our business. We will have more than double the room in our new quarters and with the addition of considerable new machinery we will be in a position to handle a much larger volume of business more promptly than we have been able to do in the past. Our shops will be equipped with a large variety of improved machinery and we will continue to manufacture a full line of telegraph instruments, fire alarm apparatus, measuring and testing instruments, X-ray machinery and our large variety of electrical specialties. Special provision will also be made for doing model and experimental work. Our laboratories will be fitted with the most modern machinery equipped for the accurate calibrating and adjusting of electrical measuring and testing instruments."

SELLERS & RIPPEY, consulting engineers, Philadelphia, have awarded to the General Electric Company, the contract for the complete electrical equipment of the hydro-electric power station now under construction at Ellsworth, Maine, for Bar Harbor & Union River Power Company. Mr. J. A. Leonard, Ellsworth, Me., is the engineer.

PLANT FOR TOLEDO.—The Central Heating & Lighting Company has placed an order with F. Bissell & Co., of Toledo, Ohio, for one 50-kw and one 100-kw generators and a switchboard to be installed in its plant in the Meredith Building, Toledo.

Financial Intelligence.

THE WEEK IN WALL STREET.—Heavy liquidation and severe declines occurred in the stock market during the week, and there was no evidence of any rallying tendency. At the close of the week the market was nervous and depressed, sentiment being influenced both by the talk of renewed friction among prominent interests and of the closing out of enormous speculative and investment accounts for such parties. The railway share list, particularly the higher-priced stocks, bore the brunt of the movement, one of the sensational features having been, however, the rallies in Reading shares on short covering, attended by uncorroborated rumors of buying for control. Sales were on a very large scale, running up to over 2,000,000 shares per day. The industrials were naturally influenced by the declines in other directions, some of the important members of that group suffering rather heavy declines, but there did not seem to be the same pressure upon the industrial group as there was upon the railroad share list. On Friday United States Steel shares were objects of heavy selling and weakened the entire market. The electric and traction groups in sympathy with the railroad list suffered declines, which in some cases were heavy, notably, Brooklyn Rapid Transit. This stock was as high as 68⅞ at one time during the week, but went down to 54¾, the net decline at the close of the week being 11⅜ points. The next heaviest decline was in General Electric, which closed at the lowest quotation of the week and of the year—149½—this being a net loss of 8 points. The other stocks did not lose so heavily, but all of them touched the lowest quotations of the year. In the curb market little business was done aside from the manipulation of several mining issues. The closing quotations of March 12 are given in the table.

NEW YORK

	Mar. 5	Mar. 12		Mar. 5	Mar. 12
Allis-Chalmers Co.	12⅞	12⅛	General Electric	153	161
Allis-Chalmers Co. pfd.	33	32¾	Hudson River Tel	...	...
American Dist. Tel	...	..	Interborough Met. Com.	25⅛	26⅛
American Locomotive	68¾	...	Interborough Met. pfd.	63	6 1⅜
American Locomotive pfd.	108⅛		Mackay Cos.	70⅜	70⅜
American Tel. & Cable	80	80	Mackay Cos. pfd.	68¾	70
American Tel & Tel.	..	...	Marconi Tel	...	...
Brooklyn Rapid Transit	59	60¼	Metropolitan St. Ry.	..	
Electric Boat	30	32	N. Y. & N. J. Tel.	...	113
Electric Boat pfd.	80	80	Western Union Tel.	80¾	81
Electric Vehicle	...	...	Westinghouse com.	150	150
Electric Vehicle pfd	...	...	Westinghouse pfd.	...	...

BOSTON

	Mar. 5	Mar. 12		Mar. 5	Mar. 12
American Tel & Tel	125¼	125	Mass. Elec. Ry. pfd	66	65
Cumberland Telephone	110	...	Mexican Telephone	4	
Edison Elec. Illum.	...	216	New England Telephone	120	118
General Electric	155	..	Western Tel. & Tel	...	6
Mass. Elec. Ry.	18	17⅛	Western Tel. & Tel. pfd.	..	...

PHILADELPHIA

	Mar. 5	Mar. 12		Mar. 5	Mar. 12
American Railways	50⅛	50	Phila. Electric	7⅞	8
Elec. Co. of America	10	9¾	Phila. Rapid Trans	20	19⅛
Elec. Storage Battery	53	55	Phila. Traction	92¾	...
Elec. Storage Battery pfd.	..	...			

CHICAGO

	Mar. 5	Mar. 12		Mar. 5	Mar. 12
Chicago City Ry.	150	150	National Carbon	80¼	80 ¼
Chicago Edison	...	..	National Carbon pfd.	115¾	115
Chicago Subway	27⅛	...	Union Traction	...	...
Chicago Tel. Co.	...	...	Union Traction pfd.	...	...
Metropolitan Elev com.	24¼	23			

WASHINGTON, D. C., REPORT.—The Washington Railway & Electric Company, of Washington, D. C., has issued its annual report for the year ended December 31, 1906:

	1906.	1905.	1904.
Gross	$3,133,240	$2,905,907	$2,644,360
Expenses	1,613,096	1,478,466	1,355,822
Net	$1,520,144	$1,427,441	$1,288,537
Other increase	44,595	50,553	49,024
Total increase	$1,564,739	$1,477,994	$1,337,562
Charges	1,041,118	999,455	981,039
Surplus	$523,621	$478,539	$356,523

The increase in operating expenses is largely due to an increased expenditure for maintenance. While the total operating expenses increased $134,630, or 9.10 per cent, the cost of maintenance increased $64,612, or 20.59 per cent, partly due to the fact that the properties have been maintained in better condition than heretofore, but more to the large increase in the cost of materials. A dividend of 5 per cent has been paid on $8,500,000 preferred stock.

COLORADO CONSOLIDATION.—A special dispatch from Denver, Col., of March 8 says: "Negotiations for consolidating the Central Colorado Power Company, capitalized at $22,000,000, and the Northern Colorado Power Company, with a capital of $10,000,000, are being carried on by Myron T. Herrick, Thomas F. Walsh, Simon Guggenheim and others interested in the Central Colorado Power Company. When the negotiations are completed the combined company will be capitalized at $50,000,000, and will supply electric light and power to almost three-fourths of Colorado. The Central Colorado Power Company was organized last November and Mr. Herrick says it will immediately expend $9,000,000 in Colorado and $40,000,000 more later."

LIGHTING IN INDIANA.—The Muncie (Ind.) *Press* says: "What appears to be a scheme toward combining the interests of certain public utility corporations, and which affects towns in Central and Eastern Indiana, is that being promoted by A. H. Pickmore & Co., a New York corporation, affecting the lighting systems of small towns and cities. The Central Indiana field seems to have been selected. The company has been in communication with a number of Indiana men, supposed to be in a position to furnish them information concerning prospective purchases, and is pushing the matter with all speed. In fact, the plants at Elwood and Alexandria have already been secured and the company's agents are now negotiating for the plants at Tipton, Arcadia and Cicero."

WARREN ELECTRIC MANUFACTURING COMPANY'S PLANT.—Having failed to receive a bid on the plant of the Warren Electric Manufacturing Company, Sandusky, Ohio, the receivers have been authorized to sell it for $40,000 at private sale, which was offered by M. H. Nason, representing the Euclid Avenue Trust Company, of Cleveland. A new company will probably be organized to operate the plant. J. F. Hayden, of Columbus, it is said, will head the company and take charge of the plant.

BROCKTON EDISON.—The Edison Electric Illuminating Company, of Brockton, Mass., has petitioned the State Gas and Electric Light Commissioners for permission to issue $55,000 additional stock for payment of floating debt and enlargement of its plant.

INSULATED WIRE CAPITAL.—The stockholders of the Philips Insulated Wire Company have voted to petition the Rhode Island Legislature for permission to increase the capital stock from $1,000,000 to $2,000,000.

INCREASE OF CAPITAL.—The capital stock of the United States Electric Porcelain Company, Findlay, Ohio, has been increased from $20,000 to $50,000.

DIVIDENDS.—Directors of J. G. White & Co., Inc., have declared the regular quarterly dividend of 1½ per cent on the preferred stock, payable April 1. Directors of the Mackay Company have declared the regular quarterly dividend of 1 per cent on the preferred stock and 1 per cent on the common stock, payable April 1. Directors of the Interborough Rapid Transit Company have declared the regular quarterly dividend of 2¼ per cent, payable April 1, to holders of voting trust certificates. Directors of the Twin City Rapid Transit Company have declared a regular quarterly dividend of 1¾ per cent on the preferred stock, payable April 1. Directors of the Philadelphia Traction Company have declared a semi-annual dividend of $2 per share, payable April 1. The Dallas Electric Corporation has declared a regular semi-annual dividend of $2.50 per share on the preferred stock, payable April 8. Directors of the United Traction & Electric Company have declared the regular quarterly dividend of 1¼ per cent, payable April 1. The directors of the Havana Electric Railway Company have declared the regular quarterly dividend of 1 per cent on the preferred stock, payable April 15. Directors of the Boston Suburban Electric Companies have declared a regular quarterly dividend of 75 cents per share on the prefrered stock, payable April 15. Directors of the Cumberland Telephone & Telegraph Company have declared the regular quarterly dividend of 1¾ per cent, payable April 1. The regular quarterly dividend of 1¾ per cent on Manhattan Railway stock paid as rental by the Interborough Rapid Transit Company for this quarter will be payable April 1. Directors of the Interborough-Metropolitan Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable April 1. The directors of the Louisville Traction Company have declared the regular quarterly dividend of 1 per cent on the common and regular semi-annual dividend of 2½ per cent on the preferred stock, payable April 1. Directors of Houghton County Street Railway Company have declared the regular semi-annual dividend of 3 per cent on the preferred stock, payable April 1. The directors of the General Electric Company have declared a quarterly dividend of $2 a share on the stock, payable April 15. Directors of the Mexican Telegraph & Telephone Company have declared a regular semi-annual dividend of 2½ per cent on the preferred stock, payable May 1. Directors of the American Telephone & Telegraph Company have declared the regular quarterly dividend of 2 per cent on the stock. The directors of the St. Joseph Railway, Light, Heat & Power Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable April 1. Directors of the Union Traction Company, of Indiana, have declared the regular semi-annual dividend of 2½ per cent on the preferred stock, payable April 1. Directors of the Butte Electric & Power Company have declared the regular quarterly dividend of 1¼ per cent on the preferred, payable March 15. The directors of the Otis Elevator Company have declared a regular quarterly dividend of 1½ per cent on the preferred stock, payable April 15. They also declared a dividend of 3 per cent. on the common stock for the year, payable in two equal installments, the first on April 15, and the second on October 15. The executive committee of the board of directors of the Western Union Telegraph Company has recommended the usual quarterly dividend of 1¼ per cent on the capital stock to be payable April 15.

HALL SIGNAL FINANCES.—As a result of the failure of the financial plan of the Hall Signal Company, which involved an increase in the company's capitalization from $2,000,000 to $10,000,000 for the sake of obtaining $1,000,000 cash, the directors undertook to provide a substitute measure which has taken definite shape. A special meeting of the stockholders has been called for March 15 at Portland, Me., to pass upon the new plan. The directors will ask authority to borrow money at such times and on such terms as they may consider advisable up to a total of $1,000,000. The capital to be thus obtained will be secured by mortgaging or pledging under any form of obligation, whatever stocks the company may have in its treasury or its plant, patents or other assets. The Hall Signal Company, which has been prosperous and on a dividend paying basis, is forced to extend its facilities, and has found serious difficulty in obtaining needed capital under existing money market conditions. The money is needed for the company's manufacturing plant at Garwood, N. J. Under the proposed reorganization scheme holders of the present outstanding $100,000 of 6 per cent cumulative preferred stock were to receive preferred stock in the new company on the basis of share for share, and dollar for dollar, with a bonus of $20 per share. A block of $1,000,000 of new preferred stock was to have been underwritten by J. S. Bache & Co. and their associates, and sold at par, to pay for the contemplated improvements. Another block of $2,000,000 of the new preferred stock was to have been reserved in the company's treasury for subsequent sale. The holders of the $1,900,000 of present common stock and the holders of $100,000 of present preferred stock were to have the first right to purchase in cash the $1,000,000 of new preferred stock to the extent of one-half of their holdings, and each purchaser of a share of new preferred stock was also entitled to a bonus of one share of new common, of which 15,000 shares were to remain in the treasury for sale.

J. G. WHITE COMPANY ENLARGING.—It is stated by the J. G. White Company, Inc., of New York City, that the additional $1,500,000 6 per cent cumulative preferred stock which the company authorized on February 15, is largely oversubscribed. Of the $500,000 additional common stock, which was also authorized at that time, none has been offered for sale. The increase in capitalization from $3,000,000 to $5,000,000 was made to provide the working capital required to handle properly a largely increased business. At the present time J. G. White & Company, Inc., has $20,470,000 of contracts on its books, none of which have been completed. Among these is the construction of 350 miles of narrow-gauge road in the Philippines for the Philippine Railway Company. For this work J. G. White & Company will receive $11,000,000, which price includes the purchase of equipment. The firm has already made a great success of the lighting and traction system developed by it at Manila.

DISTRICT TELEGRAPH REPORT.—The American District Telegraph Company, of New Jersey, has issued its annual report for the year ended December 31, 1906, as follows:

	1906.	1905.	1904.
Gross	$2,799,624	$2,534,698	$2,389,971
Expenses	2,083,798	1,842,879	1,691,176
Net	$715,826	$691,819	$698,795
Dividends	392,951	390,049	389,959
Surplus	$322,875	$301,770	$308,836
Previous surplus	721,942	55,871	111,338
Total surplus	$1,044,817	$357,641	$420,174

TELEPHONE MERGER.—The investigation into the proposed absorption of the United States Independent Telephone Company of Rochester by the American Telephone & Telegraph Company, which was stopped by the injunction proceedings brought by Attorney-General Jackson, was begun at Albany on March 7 before Joseph A. Lawson. The investigation is for the purpose of ascertaining whether the proposed transfer of stock would be in violation of the anti-trust law of this State. Mr. Frederick P. Fish, of Boston, president of the Bell Telephone Company, testified that the purpose of his company in seeking to absorb competing concerns was solely to afford better service to the public. Mr. Hall, vice-president of the company, testified substantially to the same effect.

CHICAGO EDISON NOTES.—Steps have been taken for the sale of $2,500,000 of the Chicago Edison Company debenture notes to a syndicate, including the Illinois Trust & Savings Bank, the National City Bank, of New York; N. W. Halsey & Co. and A. B. Leach & Co. The purchasers will have an option on an additional $2,500,000 of the same issue. The notes will bear 5 per cent and run three years and are understood to be taken on a 6 per cent basis. The proceeds of the sale will be devoted to the company's general extension work. It is expected that the notes will be popular in the market, as the credit of the Edison Company is excellent, and that the syndicate will exercise its option to take the second $2,500,000.

LIGHTING DEAL AT SCRANTON.—Rumors are current in Scranton, Pa., that the Lackawanna Light Company, of that city, has been absorbed by the American Gas & Electric Company, which already controls the other lighting systems of the city. The Lackawanna Company has a modern Bullock plant with Allis-Chalmers engines. The authorized capital is $400,000 stock and $500,000 bonds.

TRACTION BONDS IN LONDON.—The Southwestern Traction Company, a Maine corporation, whose purpose is to build and operate electric railways in Southeastern Kansas, is offering in London $3,000,000 of 5 per cent gold bonds.

DUTCH INVESTMENT.—It is noted in Chicago that of an issue of $2,000,000 of Chicago & Milwaukee Electric Railroad notes, $1,000,000 has been taken by banking houses in Holland for distribution among investors.

GENERAL NEWS.

Construction News.

GADSDEN, ALA.—The Alabama City, Gadsden & Attalla Railway Company has awarded the contract to build a pumping station on the river, and a 3,600-foot pipe line from the pumps to the power house to E. B. Fitts Company, of Atlanta, Ala.

ALAMEDA, CAL.—The telephone company has announced that it will spend $200,000 in improving and extending the telephone service in Alameda.

AUBURN, CAL.—William Muir, of Sacramento, and associates are building a dam just below the Colfax bridge on the north fork of the American River. Mr. Muir states that a power plant will be erected this summer at the junction of the north and middle forks of the American River for the generation of electricity at a cost of $500,000. They claim water rights on each stream to the amount of 30,000 miner's inches, which have been in continuous use and occupation since 1850.

COMPTON, CAL.—The Compton Lighting & Power Company has purchased a franchise through G. R. Fulton, and has filed articles of incorporation with a capital of $50,000. The company will immedaitely begin preparations for the erection of a 6,000-light plant on Pomegranate Street.

LODI, CAL.—Work is being rapidly pushed on the Lodi extension of the California Traction Company. Dynamos and motors of 300 hp capacity have arrived, which will be placed in the sub-station to be located at Mosher.

OAKLAND, CAL.—Improvements to the amount of over $1,000,000 will be made immediately by the Pacific States Telephone Company in its plant in this city. The company will place many of its wires in underground circuits.

PORTERVILLE, CAL.—The Mt. Whitney Power Company is building a new power plant on the Tule River which will take about two years to complete. The flume will be about eight miles long and the fall that will be obtained in this distance will develop 3,000 horsepower, a greater capacity than either one of the Kaweah plants.

ST. HELENA, CAL.—Henry M. Pittman has secured the consent of the Board of Trustees of this place to cause an advertisement for the sale of an electric light franchise in this city to be made. The franchise will be put up in about 30 days.

SAN FRANCISCO, CAL.—The United Railroads is rebuilding its cable power house at Washington and Mason Streets to almost twice its original size. Oil will be used for fuel.

SAN FRANCISCO, CAL.—The Bay Counties Electric Railroad Company is now making surveys and making arrangements for the construction of its road. Richard Hoatling is one of the principal incorporators.

SAN JOSE, CAL.—Plans have been made by the Pacific Telephone & Telegraph Company for a complete overhauling and rebuilding of its local system. A new telephone building will be erected. A complete electrical plant will be installed in connection with the central exchange equipment, and a reserve plant will be installed for use in case of emergencies or breakdown.

SANTA CRUZ, CAL.—The Big Creek Power Company has under contemplation increasing the capacity of its plant to 5,000 hp. A concrete dam will be built 50 ft. high across the creek near its headquarters, and a new pipe line will also be built. To provide against emergencies a steam auxiliary plant of 1,000 hp will be erected near the Cottage City.

SONORA, CAL.—The Tuolumne Electric Company, C. W. Quilty, of San Jose, general manager, is erecting a hydro-electric plant on the Tuolumne River, six miles north of Groveland. The plant, which is all completed except the construction of about 8,000 feet of flume, will probably be in operation about the middle of April. When finished the company will have 4½ miles of flume and will generate 2,200 horsepower. The plant is constructed for 10,000 horsepower, which will be developed as rapidly as the demand warrants.

TAYLORSVILLE, CAL.—J. C. Taylor, of this place, is now considering the proposition of installing an electric lighting plant at this place for the purpose of supplying electricity for lighting purposes to the entire Indian Valley, including the towns of Greenville and Crescent Mills.

WILLOWS, CAL.—C. L. Schaad, president, and A. S. Lindstrom, electrical engineer of the Colusa County Telephone Company, are engaged in locating lines for a hydro-electric plant to be installed on Stony Creek. It is said that a site has been selected for a power house.

COLORADO SPRINGS, COL.—Fred Nexon, of this city is offering electric energy at two and one-half cents per kw-hour. The offer is made on behalf of the Tarryall Power & Reservoir Company, which is being promoted by Chicago capitalists, who contemplate the construction of a plant on the Platte River to be completed by the end of the year.

DENVER, COL.—It is reported that the Denver & Rio Grande Railway Company is planning to electrify its system. Estimates for furnishing electricity for operating the road have been furnished by the Central Power Company. The last-named company is now erecting a hydro-electric plant on the Grand River at Core Canyon. The diviison between Denver and Pueblo will be changed first.

HARTFORD, CONN.—The Consolidated Railway Company is contemplating the construction of an electric railway from Dayville through Attawaugan and Ballouville to Pineville this spring.

NEW HAVEN, CONN.—The United Illuminating Company has announced that it will place its wires underground in the business section of the city this spring. Permission for this improvement was granted to the company last fall by the city.

NORWICH, CONN.—The Consolidated Railway Company is making an addition to its power house in this city and will install several new boilers. It is also planned to install additional engines and dynamos.

WINSTED, CONN.—C. S. Palmer, Meriden, is preparing plans for a building to be used as offices and power station for the Winsted Light & Power Company.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 19, to furnish at the navy yards at Portsmouth, N. H., Boston, Mass., Newport, R. I., New York. N. Y., League Island, Pa., Annapolis, Md., Washington, D. C., and Norfolk, Va., a quantity of naval supplies as follows: Schedule 475—Feeder cable, switchboard, electrical supplies. Schedule 476—Electric hoists, etc. Schedule 489—Ingot copper, manganese bronze, etc. Applications for proposals should designate the schedules desired by number. E. B. Rogers, Paymaster General, U. S. N.

ST. AUGUSTINE, FLA.—Work has commenced on installing the power system for the local street railway. The beach road will be electrified during the summer, and extensions will be built to North City and to New Augustine.

TAMPA, FLA.—The Tampa Electric Company is contemplating increasing its capital stock by $400,000, the proceeds of which will be used to make extensions and improvements to its system.

ATLANTA, GA.—A report has been made by the Hall-Illges Company to the Special Committee appointed to investigate the city ownership of an electric light plant. The engineers estimate an annual outlay for running expenses at about $247,000. Two sites are suggested, one at the water works to cost $271,970, and the other at the incinerating plant to cost $262,520.

ATLANTA, GA.—It is said that improvements amounting to several hundred thousand of dollars were decided upon at a recent meeting of the directors of the Georgia Electric Railway & Light Company. The work will consist of rebuilding of several of the present lines, and extensions to many others and the construction of the new Hapeville line.

BRUNSWICK, GA.—F. D. Strachan and associates have applied to the City Council for a franchise for a street railway system and an electric light and power plant and gas plant. They offer to furnish arc lamps of 450 watts capacity at $75 per lamp per annum; electric energy for incandescent lamps at 10 cents per kw-hour and for motor purposes at 7½ cents per kw-hour.

BRUNSWICK, GA.—A syndicate headed by Joseph M. Roman, of Joseph M. Roman & Company, of Atlanta, Ga., engineers, has petitioned the City Council for a franchise for an electric light and power plant and street railway system. A proposition has been submitted to the Council offering to furnish electricity for lighting at 10 cents per kw-hour, and to give to the city a rebate of 25 per cent; electric energy for power purposes seven cents per kw-hour; electric lamps of 30-cp to replace the present gas lamp on a sliding scale; 100 or less at $21 per lamp per year, 100 to 200 at $20; 200 to 300 at $19, and over 300 at $18.50. Arc lamps of 450 watts at $75 per lamp per year under 100; from 100 to 200 at $70; from 200 to 300 at $65, and all over 300 at $62.50 each. The company agrees to commence construction within 120 days if given a franchise. R. E. Briesennick, of Brunswick, is also interested in the project.

COLLEGE PARK, GA.—J. S. Arnold, city clerk, writes that Solomon Norcross Company, of Augusta, is preparing plans and specifications for water works, an electric light plant and sewerage system. The election to vote on question will probably be held in the fall.

MACON, GA.—The promoters of the Atlanta, Griffin & Macon Electric Railway have engaged Arthur Geisler, New York, N. Y., to make investigations for the development of new water powers to furnish electricity for the operation of the proposed railway.

MACON, GA.—Bids will be received until Apr. 4 by James Knox Taylor, Supervising Architect, Washington, D. C., for installing a conduit and wiring system in the enlargement of the U. S. Court House, Post Office, etc., at Macon.

LEWISTON, IDAHO.—The hydro-electric plant of the Lewiston-Clarkston Company has been completed and put in operation. The new plant is located on Asotin Creek, ten miles from Lewiston, and takes the place of the steam plant at Clarkston, which now will only be used as an auxiliary station, to use in emergencies. The new plant has a capacity of 2,500 hp and cost $100,000. The company has now under consideration the construction of another hydro-electric plant on the Grande Ronde River, at a cost of about $850,000.

MEADOWS, IDAHO.—B. A. Chisholm and Edward Goodman are interested in the construction of an electric power plant at the falls of the Little Salmon, 16 miles below here.

EVANSTON, ILL.—The City Council has granted the Chicago, Evanston & North Shore Electric Railway Company a 50-year franchise to construct an electric railway through the city to Bowmanville. The compensation is fixed at $66,250, and the company agrees to allow the city to use its poles for electric light wires and to maintain electric lamps at each street crossing.

EAST ST. LOUIS, ILL.—The East St. Louis Suburban Company has applied to the City Council for a franchise for several routes through the streets of the city for a street railway. The company has secured the McKinley franchise in this city.

GALENA, ILL.—A franchise has been granted to the Illinois & Western Railway Company to build an electric railway in this place.

JACKSONVILLE, ILL.—The Alton, Peoria & Jacksonville Railroad Company has voted to increase its capital stock from $300.000 to $800,000.

JERSEYVILLE, ILL.—The stockholders of the Alton, Jacksonville & Peoria Railway Company have voted to increase the capital stock of the company from $300,000 to $800,000. A meeting of the board of directors was subsequently held when a bond issue of $800,000 was authorized.

PARIS, ILL.—The directors of the Paris Traction Company are considering the proposition to extend its line to Chrisman, a distance of 13 miles. It is estimated that the extension can be built for $200,000.

PARIS, ILL.—At a recent meeting of the stockholders of the Wabash Valley Telephone Company it was decided to move the home office from Marshall to Paris, and to increase the capital stock from $120,000 to $400,000.

ANDERSON, IND.—The directors of the Madison-Delaware County Telephone Company have decided to erect a new exchange building in this city. Much of the system will be rebuilt..

BLOOMINGDALE, IND.—Plans are now being considered for the construction of a local electric light plant in this place.

FORT WAYNE, IND.—The contract for the construction of the interurban railway which is to connect Fort Wayne and South Bend has been awarded to the Indiana & Illinois Construction Company by the directors of the Fort Wayne & South Bend Railway Company.

GREENFIELD, IND.—Dr. Frank W. Cregor, of Carthage, receiver for the Hannah-Jackson Telephone Company, has been instructed by the Hancock Circuit Court to sell the plant at public auction in this city March 30.

GREENWOOD, IND.—The Town Council has granted the Citizens' Water & Light Company a 25-year franchise for supplying water and light. The contract provides for twenty-five arc street lamps.

PERU, IND.—The impaired condition of the city electric light plant is such as to require improvements estimated to cost $15,000. Instead of making this expenditure the City Council is considering a proposition of the Fort Wayne & Wabash Valley Traction Company to furnish electric energy to run the city lighting plant at the rate of 3 cents per kw-hour delivered at the city switchboard.

WESTFIELD, IND.—Hinshaw & McKnight, local capitalists, are asking for a franchise for electric light and power plant in this town.

ATLANTIC, IA.—The amount of money required to guarantee the construction of the Atlantic, Northern & Southern Railroad has been raised in Atlantic. The directors have decided to make a preliminary survey and commence the work at once.

CEDAR RAPIDS, IA.—The Cedar Rapids Street Railway Company is contemplating increasing its capital stock and making improvements to its plant, the cost of which is estimated at $100,000. William C. Dowe is manager.

DUNCOMBE, IA.—M. F. Harkins, town clerk, writes that the Council has decided to postpone voting on the question of issuing bonds for electric light plant until summer or fall.

KEOKUK, IA.—The Keokuk-Columbus Junction electric railway has been organized and proposes to push the matter of the construction of the line. T. A. Craig, of Keokuk, is secretary.

SIOUX CITY, IA.—A. A. Smith, City Clerk, writes that a committee has been appointed to consider the advisability of constructing a municipal electric light plant.

TIPTON, IA.—The final survey for the Iowa City, Tipton & Davenport Interurban Rilway is nearly completed and it is expected that work on the construction of the line will commence early this spring. The plans of the company contemplate the construction of a dam across the Cedar River, a short distance above Rochester, where a hydro-electric plant will be erected, to furnish electricity for operating the railway.

WICHITA, KAN.—The Wichita Gas & Electric Company has petitioned the City Council to grant a three-year extension to its franchise, in return for which the company offers a material reduction in the cost of electricity for lighting and power to consumers and also permit the city to purchase the plant at the end of eight years.

WICHITA, KAN.—The United Gas Company, which recently purchased the property of the Wichita Gas, Electric Light & Power Company, has announced that new machinery will be purchased for the electric light plant at a cost of from $75,000 to $100,000.

NEW ORLEANS, LA.—The Algiers Railway & Lighting Company is preparing to build its electric line in Algiers. Leigh Carroll is president

AUGUSTA, ME.—The bill of the Union Water Power Company, of Lewiston, asking for authority to lower the water in two of the Rangeley lakes has been defeated by an adverse vote in the Senate of the Legislature.

FREDERICK, MD.—The Frederick & Middletown Electric Railroad Company and the Jefferson & Braddock Heights Railroad Company have been consolidated and will hereafter operate the entire system under the name of the Frederick Interurban Railroad Company. The capital stock of the new company is $1,000,000 and the incorporators are Emory L. Coblentz, of Middletown; Thomas H. Haller and Richard Ross, of Frederick; James E. Ingram, Jr., and Robert R. Graham, of Baltimore. The company will increase the capacity of the present power plant by either enlarging it or building a new power house. It will also make other extensive improvements and additions to the Braddock Heights system.

GREENFIELD, MASS.—The construction of a street railway from Greenfield to Northfield is now under consideration by the citizens of Northfield, Bernardstown and Greenfield. The line will be 13 miles long and the estimated cost of the road is $300,000.

LAWRENCE, MASS.—The Pacific Mills Company is preparing to erect a large power house to supply electricity to operate its mills. The company has applied to the City Council for permission to lay the necessary conduits, poles, etc., for the transmission of electricity.

NORTHAMPTON, MASS.—The Selectmen have granted a franchise to the Easthampton Electric Lighting & Power Company, of Amherst.

SPENCER, MASS.—The construction of a municipal lighting plant is now being considered by the business men of this place. The question will be submitted to the voters at the next town meeting, which will be held in April. Senator Charles N. Prouty, Judge Albert W. Curtis and J. R. Kane are among those who are interested in the movement.

WAREHAM, MASS.—At a recent town meeting the citizens voted to authorize the expenditure of $2,000 for street lighting, which was appropriated through the agencies of several improvement societies of the town.

ALLEGAN, MICH.—The Allegan Electric Light & Power Company is negotiating for the property belonging to the Farmers' Milling Company, including the water-power rights. If the deal goes through the company will at once take steps to utilize its water power to its full capacity.

ESCANABA, MICH.—T. J. Burke, city clerk, writes that bids will be received on March 23 for improvements to the electric light plant, to include the purchasing of one 175-kw generator complete, a new switchboard complete, wiring, apparatus, etc., one 600-horsepower heater and a pump to provide water for all purposes. The probable cost of work is placed at $16,000.

GRAND RAPIDS, MICH.—The Board of Public Works has approved the report of General Manager Samuel A. Tushney, of the municipal electric light plant, recommending that the lighting plant be turned over to the Grand Rapids-Muskegeon Power Company. An offer has been made by the company to furnish electricity at the switchboard at a price which would reduce the annual cost of the street lighting $6,000. The company offers to enter into a contract with the city for a term of three years to furnish electric energy for the street lamps at a half a cent for each hour, which is an average for each lamp of $18.70 a year, making a total cost to the city for 800 lamps of $14,964 a year. The city plant is not to be used for any other purpose and to be returned to the city in good condition at the expiration of the contract period. The contract now waits the approval of the Common Council.

LEWISTON, MICH.—The M. & H. Lumber Company of this place will install an electric lighting plant and will furnish light to the village and to private consumers.

MENOMINEE, MICH.—The Davis Electric Company of St. Louis, Mo., has sold its entire plant in that city to the Menominee Electric Manufacturing Company. The plant and machinery will be moved to this city about April 1.

YPSILANTI, MICH.—J. L. Millspaugh, superintendent of the Detroit, Jackson & Chicago Electric Railway, has announced that the company will extend its line from Saline, through Clinton and Tecumseh to Adrian.

ALBERT LEA, MINN.—H. C. Higgins, City Clerk, writes that the city has made a contract for commercial lighting for five years, so that it will not again consider the construction of a municipal plant for some time.

DULUTH, MINN.—The Duluth Street Railway Company has made arrangements with the Great Northern Power Company to furnish electric power for operating its street car system in this city.

OWATONNA, MINN.—J. P. Thon is interested in the construction of an electric light and heating plant

SLEEPY EYE, MINN.—Plans are being considered for a new lighting plant in this place.

NATCHEZ, MISS.—The date of opening of bids for lighting the city for 10 years has been extended from March 7 to May 1. A. C. Berdon is chairman committee on light and water.

CENTRALIA, MO.—H. W. De Jaruott, City Clerk, writes that the bonds recently voted for the electric light plant is to pay for the purchase of the plant already in operation. The citizens also voted on Feb. 26 to issue $40,000 bonds to construct water works. Burns & McDonnell, of Kansas City, are the engineers.

HANNIBAL, MO.—The Central Union Telephone Company is planning to make extensive improvements to its system in this place, which will involve an expenditure of $36,000.

JOPLIN, MO.—The Cherokee Power Company is contemplating the construction of a large electric plant in this city.

KANSAS CITY, MO.—Harry N. Evans, M. C. Ford, Henry C. Solomon, Elmer N. Powell and Edward D. Ellison have applied to the City Council for a franchise to furnish electricity for lighting and power in this city. William M. Hall, owner of the Hall Building, has also applied for a franchise. Both franchises ask for the right to charge eight cents per kw-hour for electricity. Mr. Hall offers three per cent of the gross receipts of his plant to the city. Henry N. Evans and associates offer two per cent.

GREAT FALLS, MONT.—The Westinghouse Electric & Mfg. Company is reported to be preparing plans, specifications and estimates for the complete electrical construction and equipment of a hydraulic electric generating plant, to be located on Missouri River, below Great Falls, for the Missouri River Improvement Company.

BEATRICE, NEB.—The Filley Independent Telephone Company has increased its capital stock from $3.000 to $9,000, for the purpose of making extensions and improving the plant.

TECUMSEH, NEB.—C. M. Wilson, City Clerk, writes that the citizens on Mar. 5 voted to issue $12,750 bonds for constructing an electric light plant.

TEKAMAH, NEB.—At a recent meeting of the City Council an ordinance was passed calling for an election to vote on the proposition of issuing $10,000 for the construction of a municipal electric lighting plant.

FALLON, NEV.—The United States Reclamation Service is planning to erect a power plant on the Truckee-Carson irrigation canals in Churchill County. It is the plan of the Government to generate electrical power and transmit it to the forms to be irrigated by the canals. This power will then be used in operating pumps which will irrigate all land above the level of the irrigation canals.

GOLDFIELD, NEV.—The construction of an electric railway from Goldfield to Tonopah in the near future is now being considered by A. Bonham, of Los Angeles. It is said that a power house will be erected half-way between here and Tonopah. The street railway franchise, which was recently applied for, will be sold to the highest bidder on June 3.

CAMDEN, N .J.—The city has recently installed an electric lighting plant in the Morris Station water plant. The plant furnishes electricity for 14 arc lamps and 60 incandescent lamps at the water works system.

HADDONFIELD, N. J.—J. H. Young, of Philadelphia, Pa., has been selected to prepare plans for water works and electric light plant, to cost about $125,000.

JERSEY CITY, N. J.—Walter O'Mara, of Jersey City, clerk of Board of County Freeholders, writes that all bids opened on Feb. 25, for installing an electric light system in the county almshouse and county farm at Secaucus have been rejected, and new bids will be received.

NEWARK, N. J.—The Common Council has practically decided to grant the application of the Newark Block Lighting Company to do commercial lighting in Lawrence Street and in Market Street to Broad Street.

NEWARK, N. J.—The Special Committee appointed by the Common Council, to investigate and report on the feasibility of establishing a municipal electric light plant, operated by turbine water power, acquired from the city's watershed, has selected Fred. O. Runyon as its Consulting Engineer.

AUBURN, N. Y.—The Auburn & Northern Electric Railroad Company has been granted authority by the State Railroad Commission to increase its capital stock from $250,000 to $1,500,000. The company is to operate a street railroad from Auburn to Port Byron and from Auburn to Cayuga and across Cayuga Lake to Seneca Falls.

CHEEKTOWAGA, N. Y.—The Cheektowaga Railway Company has been granted a franchise to build an electric railway in this town. The road will be six miles long and double tracked. The company has been incorporated with a capital stock of $75,000 and will now apply to the State Board of Railroad Commissioners for a certificate of necessary. The incorporators are Charles L. Williams, William H. Kinch and E. L. Ryan.

GENEVA, N. Y.—The Supervisors of Ontario county, at Canandaigua, have decided to install an electric plant in the armory at Geneva.

HUDSON, N. Y.—William Wortman, city clerk, writes that Jonathan T. Rider, of Hudson, submitted a bid on Feb. 28 for lighting the streets and public buildings by electricity at $49 per arc lamp per year, and $10 each per year for 32-cp incandescent lamps.

LOCKPORT, N. Y.—At a recent meeting of the directors of the Economy Light, Fuel & Power Company a bond issue of $250,000 was authorized for the purpose of purchasing additional generating and electrical equipment.

NIAGARA FALLS, N. Y.—Plans are being made by the Ontario Power Company to enlarge the capacity of its power house on the Canadian side of the river at Niagara Falls. An addition is to be made to the power house 160 feet in length, to provide for space for two additional generators of 12,500 hp each.

PENN YAN, N. Y.—The Hornell, Bath & Lake Keuka Electric Railway will make another application to the State Board of Railroad Commissioners for granting a certificate of necessary.

POUGHKEEPSIE, N. Y.—The Poughkeepsie Light, Heat & Power Company has taken over the plant of the Central Hudson Construction Company.

SYRACUSE, N. Y.—Plans have been prepared by Paul Ott, of Chicago, Ill., for improvements to be made at the plant of the Bartels Brewing Company, at a cost of about $150,000 The improvements include improvements to the electric lighting plant. Wherever possible electricity is to be substituted for steam.

SYRACUSE, N. Y.—The Syracuse, Lake Shore & Northern Railroad Company has received authority from the State Railroad Commission to increase its capital stock from $2,500,000 to $3,500,000.

UTICA, N. Y.—The Oriskany Hydro-Electric Company, recently organized to develop 3,500 hp on Oriskany Creek to supply electricity to operate a system of interurban roads south from Utica, is now having plans prepared for the construction of the power plant and the road. Edwin H. Risley, of Utica, is interested in the project.

CHARLOTTE, N. C.—The S. Morgan Smith Company, of York, Pa., has been given the contract for three-fourths of the water-wheel instalaltion at the Rocky Creek station by the Southern Power Company for approximately $120,000. The Rocky Creek station is located just below the Great Falls station, on the Catawba River, near Fort Lawn, S. C. The machinery contracted for will furnish 30,000 hp.

GASTONIA, N. C.—Mr. C. I. Burkholder, general manager of the Southern Power Company, is perfecting aarrangements for the erection of a substation at Gastonia. The company already has contracts to furnish electricity to a number of Gastonia mills.

RALEIGH, N. C.—The Joint Senate and House Committee reported on Feb. 25 favorably the bill appropriating $50,000 for building and equipping a power, heating and electric plant at the Agricultural and Mechanical College.

ARLINGTON, OHIO.—The citizens have voted to issue $15,000 in bonds for an electric lighting plant.

CINCINNATI, OHIO.—The Union Gas & Electric Company recently purchased a tract of land in the east end of Cincinnati, upon which a large central station will be erected. The land has a frontage of 1,100 feet on the Ohio River. The plant, as planned, will have a capacity of 100,000 hp. The location was selected in order to secure good facilities for unloading coal directly from barges into the bins.

CLEVELAND, OHIO.—The new N. Y. P. & O. docks here will be equipped with an electric power plant, which will be installed under the supervision of Engineer F. C. Werk.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company has begun work on a new building for a sub-station at Collinwood. The station will cost about $80,000 and will be capable of distributing 11,000 kw transmitted from the central station by conduit.

COLUMBUS, OHIO.—The Columbus Electrical Works Company has leased a building at the corner of Spring and Front streets which is now being remodeled to meet its requirements. The company will make electrical supplies.

COLUMBUS, OHIO.—Governor Harris, Auditor of State Guilbert and Attorney General Ellis, acting as a special committee, have decided to install a hot water and lighting system in the institution for the deaf and dumb to cost about $30,000. The Columbus Public Service Company made a proposition to install the system and furnish heat and light at the rate of $14,400 per year on a five or ten-year contract. Under the State laws, the contract must be let on competitive bids.

MANSFIELD, OHIO.—The Mansfield Telephone Company is contemplating improvements to its system which will cost about $10,000.

ORRVILLE, OHIO.—The United Telephone & Swltchboard Company, of Orrville, was at auction on Feb. 27. The entire plant was purchased by Warren Ramsey at $6,500. The company manufactures a full line of telephone apparatus. The plant will continue operation.

PAINESVILLE, OHIO.—An ordinance has been passed by the City Council to issue $10,000 in bonds for the purpose of enlarging and improving the electric lighting plant in this city. S. J. Potts is president of the Council.

WARREN, OHIO.—The Bell Telephone Company is having plans made for putting its wires in the business portion of this city in underground conduits.

VALE, ORE.—Hope Brothers & Fulton are now installing an electric light plant. It is understood that the building abandoned by the Vale Milling Company will be used by the new company for its power house.

BELLEFONTE, PA.—Jas. Woods, of Huntingdon, and Wallace Wilson, of Alexandria, are interested in the construction of a power plant on Penns Creek, near Lindale.

BRADFORD, PA.—The Western New York & Pennsylvania Traction Company is planning to construct another railway between this city and Carrollton.

DUNCANVILLE, PA.—The Borough Council has granted the Blair County Light, Heat & Power Company a franchise to erect its poles and wires and furnish electricity.

JOHNSTOWN, PA.—The Common Council has two ordinances granting franchises to the Southern Cambria and the Johnstown Terminal companies.

KENNETH SQUARE, PA.—The Kenneth & Coatesville Railway Company has been incorporated with a capital stock of $120,000, to construct an electric road from Kenneth Square to Coatesville, a distance of 12 miles. J. Walter Taylor is president of the company.

MAHANOY CITY, PA.—The Borough Council has awarded to the People's Light Company the contract for lighting the streets for a term of 10 years.

PENNSBURG, PA.—The Town Council has selected Frank G. Ortt to prepare plans for the construction of an electric light plant.

PITTSBURG, PA.—Charters for new lighting companies in West Elizabeth and Dravosburg have been applied for by J. B. Van Wagerner, A. E. Dubois and Clarence W. Scheck, of Pittsburg. The companies, which will be known as the West Elizabeth Electric Company and the Dravosburg Electric Company, will furnish electricity for light, heat and power to the towns named. They will be subsidiary to the West Penn Electric Company and the proposed new lines will form an important link in the circuit of lines, which is being operated from the central power plant at Wilmerding.

WEST POINT, PA.—The Montgomery County Rapid Transit Company has awarded a contract to the Westinghouse Manufacturing Company for generators and engines at a cost of over $60,000.

WILKESBARRE, PA.—A committee has been appointed by City Council with W. A. Richard, as chairman, to inquire into the advisability of establishing a municipal gas and electric light plant.

HURON, S. D.—Richard Clark has made application for a street railway franchise in this place.

SIOUX FALLS, S. D.—The Council has granted a franchise to F. M. Mills and associates to construct a street car line in this place.

BROWNSVILLE, TENN.—The Burt Smith Company, which owns and controls the Brownsville light plant, ice plant and other industries, has been sold by order of the Chancery Court of Haywood County to satisfy bonds amounting to $30,000. The purchasers of the plant are H. L. Currie, W. S. Lee, William Thomas, Norman M. Byars, James Tipton and A. A. Sternberger, of Brownsville. These men will take immediate possession of all of the Burt Smith property and form a new corporation, which will be known as the Brownsville Light & Power Company.

CHATTANOOGA, TENN.—Adams & Alsup are preparing plans for a power house to be erected by the Chattanooga Implement Company. A dynamo of at least 325-kw is to be installed.

HOUSTON, TEX.—F. G. Reed and K. S. Slusher are interested in a project to organize a local company for the purpose of installing an automatic telephone system in this place.

KILLEEN, TEX.—Owing to the increasing demand for electricity the electric light company has exchanged its dynamos and engine for larger ones and is now giving all night service. The company is making arrangements to furnish a day service for fans this summer. The company recently increased its capital stock to $10,000.

FERRON, UTAH.—C. L. Allen & Company, of Castledale, have been granted a franchise to install an electric light system in the town of Ferron. Franchises are also reported to have been granted to this company to install electric light and power systems throughout the county of Emery and in the towns of Huntington, Orangeville and Castledale.

ALEXANDER, VA.—E. E. Mandeville, secretary and treasurer of the Alexandria Electric Company, has notified Mayor Paff that the company is now ready to furnish electricity for lighting the streets of the city and is ready to carry out its agreement to take over the old plant and pay to the city the sum of $3,500, as agreed in the contract.

CLIFTON FORGE, VA.—Bids will be received by E. O. Snead, President Village Council, until Apr. 8, for the purchase of a franchise for lighting the streets by electricity. J. A. Gleason is chairman Water and Light Committee.

LYNCHBURG, VA.—The joint Committee on Lights has agreed on a proposition under which it will recommend a ten-year contract with the Lynchburg Traction & Light Company at 13½ cents a lamp per night, with the privilege at the end of four years for the city to purchase the internal part of the plant at cost, without interest or deduction for depreciation. If, however, the city should decide to take the system over and supply its own light then the price will be 15 cents a night, and the city will have to pay the difference when it buys the plant.

PETERSBURG, VA.—S. H. Turner, of Petersburg, secretary of the Nottoway Hydro-Electric Company, writes that Marcus R. Williams, of Poplar Mount, Va., is preparing plans for the construction of dam, canal and power plant for the development of electric power at a cost of $150,000.

BELLINGHAM, WASH.—It is reported that Stone & Webster, owners of the Whatcom County Railway & Lighting Company, are planning the erection of an addition to their Noosack Falls power plant, to cost $500,000.

COLFAX, WASH.—At a meeting of the City Council held recently Messrs. Codd & McKenzie, proprietors of the electric light system, submitted a proposition to the Council and offered to make a reduction on city lighting provided the Council would grant them another five-year franchise. They also offered to reduce the price of arc lamps from $7.65 to $7 per lamp per month. Messrs. Codd & McKenzie have a contract with the city which will not expire until May 1, 1909.

SEATTLE, WASH.—The Seattle Electric Company has secured a site for a new power plant.

ROWLESBURG, W. VA.—H. R. Hollis, Town Recorder, writes that bids for constructing the proposed electric light plant, for which $12,000 bonds were recently sold, will not be received until about July.

CHILTON, WIS.—The Central Construction Company, of Oshkosh, Wis., is installing an electric light and power plant for the Calumet Dairy Company. The plant will furnish electricity for light and power for the new cold-storage building. All the machinery and elevators will be operated by electricity and the building and yards will be lighted by electricity.

JACKSON, WIS.—The Jackson Telephone Company has increased its capital stock from $2,000 to $4,000.

KENOSHA, WIS.—An election will probably soon be held to vote on the question of constructing a municipal electric light plant. Wm. Ross, of Milwaukee, estimates the cost at about $45,000.

LA CROSSE, WIS.—The La Crosse Gas & Electric Company has made a contract with the La Crosse Water Power Company for the distribution of electricity from its plant throughout the city. D. G. McMillan is president.

MADISON, WIS.—The State Senate on Mar. 6 passed the bill authorizing the Capitol Commission to construct a power and lighting plant separate from the main building and to secure the necessary property.

MILWAUKEE, WIS.—The Milwaukee Independent Telephone Company has closed contracts for 2,000,000 feet of conduit tiling, at a cost of more than $100,000. The company has bids for poles, cables and wiring under consideration for which contracts will soon be placed. H. D. Critchfield is president.

MILWAUKEE, WIS.—The plant and telephone exchange of the Standard Telephone & Electric Company were sold Mar. 4. The plant in this city was sold for $4,150 to E. C. Hennis, of Milwaukee, and the telephone exchange at Sheridan, Wis., was sold to A. L. Von, of Almond, for $1,735.

MILWAUKEE, WIS.—At a recent meeting of the Board of Public Works and Council advisory committee it was decided to receive competitive bids for both gas and steam machinery for the proposed municipal lighting plant, although H. S. Bowen, engineer, has recommended that steam machinery should be purchased. The cost of a 4,500-hp plant with three 1,200-kw direct-connected engine units is given at $380,000.

OSHKOSH, WIS.—The Buckstaff-Edward Company is to enlarge its furniture plant and will also install an electric power plant. The power plant will cost about $5,000 and electricity will replace steam as far as possible in the manufacturing plant. The electric equipment will be furnished by the Central Construction Company of this city.

PRAIRIE DU SAC, WIS.—J. S. Tripp, of Prairie du Sac, writes that a company has been formed there, with a capital of $1,500,000, to construct a dam over Wisconsin River for power purposes. Application for charter is now pending in State Legislature. Robert Buerki, of Sauk City, Wis., is also interested.

REEDSVILLE, WIS.—The citizens have voted to issue bonds for a municipal lighting plant to be operated in connection with the water works.

COBALT, CAN.—The Silver Belt Electric Railway Company is contemplating the construction of an electric railway from Latchford to Cobalt and New Liskeard. Branches will also be run into the mining camps. Harvey Graham is president of the company.

WETASKIWIN, CAN.—At a recent election the citizens voted to spend $30,000 in improving the electric lighting plant. Address Duncan McEarchan.

VIRDEN, MAN.—The ratepayers of the municipality of Wallace have decided to install a municipal telephone system. Address Reeve Stinson.

MONCTON, N. B.—The Council is seeking authority to construct a municipal telephone system at a cost of $40,000. Address the mayor.

PETERBOROUGH, ONT.—The Peterborough Light & Power Company has offered to dispose of its electric light plant, not including its power-houses, machinery, or power, for $207,500. This offer includes, however, the entire gas plant. The company also agrees to sell the city 1,500 electric hp at $15 per hp for a term of years. The electric power will be required to operate the lighting plant.

TORONTO, ONT.—The Ontario Hydro-Electric Power Commission has submitted to the Toronto City Council its estimates of the cost of power delivered to the consumer in Toronto. This takes into account the cost of distribution by the city, as well as the commission's charges for power. The rates, according to meter, vary from $45 per hp per annum for a 10-hour day, if one hp is used, to $18 per hp per annum if 200 hp is used. The rates are less than half those charged by the Toronto Electric Light Company, which run from $51 to nearly $200.

CHIHUAHUA, MEX.—A company has been formed recently to build an electric railway in this city, of which A. C. Nash is general manager. The new company takes over the present horse car system, the electric light and power plant of the Cia. Industrial Mexicana and the Mineral Railroad which runs from this city to Santa Eulalia. It is said that the electric plant has sufficient engine capacity and only the boiler capacity will have to be increased. Enrique C. Cuel and Juan Cuel are the owners of the new company.

OAXACA, MEX.—A contract has been signed with S. P. Applewhite, of Mexico City, for the development of electricity on the Rio Grande, District of Cuicatlin, in this state. Electric energy is to be transmitted to the City of Oaxaca and to the different mining camps.

PINOS ALTOS, MEX.—The company owning the Pinos Altos mines is preparing to put in a hydro-electric plant about three miles from the town. The surveys have been made by J. H. Cooper, of Parral.

SALTILLO, MEX.—It is reported that two electric light and power plants are contemplated for Saltillo; E. Hermann is interested in one, while Alfred Lilliandahl, of Saltillo, is interested in the other, for which a concession has been granted by the government. The latter will use the water at the Choro de Aqua, near Arteaga, Coahinla, to furnish the power.

New Incorporations.

HEARNE, TEX.—The Hearne Light & Power Company has been incorporated with a capital of $20,000. Incorporators: G. H. Albers, H. S. Morehead, W. T. Bartholmew and others.

ROCKWALL, TEX.—The Rockwall Electric Light Company has been incorporated with a capital of $5,000 by W. C. Bishop, L. J. Austin and others.

STEPHENVILLE, TEX.—The Stephenville, North & South Railway Company has been chartered with a capital stock of $250,000 to build a railway from Hamilton to Stephenville. The incorporators are B. C. Gage and others.

WEAVER, TEX.—Articles of incorporation have been filed for the Weaver Telephone Company with a capital stock of $1,200 by H. B. Davidson, A. W. Sparks, Jr., and S. T. King.

MOAB, UTAH.—The Blue Mountain Telephone & Electric Company has filed articles of incorporation with a capital stock of $10,000. D. L. Gouldelock is president.

MONTPELIER, VT.—The Vermont Light & Power Company, with a capital stock of $1,000,000, has been organized to take over the Viles electric plant. The new company is a holding and was organized by the men interested in the Consolidated Lighting Company. The incorporators are: A. D. Bennett and John C. Tomlinson, of New York; George C. Moore, of Port Huron, Mich.; J. E. Davidson, of Montpelier, and Clarence H. Senter, of Montpelier. The company is incorporated to buy, sell and own lands for the manufacturing of electric power for heating, lighting and other purposes.

BRISTOL, VA.—The Holston Water, Electric & Power Company has been incorporated here, to develop water power in Holston River, near Bristol, for generating electricity. Dr. M. L. Fowler is president.

DIAMOND, WASH.—The Diamond Telephone Company has filed articles of incorporation with a capital stock of $2,000. The incorporators are F. W. Ertel, W. M. Lee and Henry Rock.

EVERETT, WASH.—Articles of incorporation have been filed for the Puget Sound, Skykomish & Eastern Railway Company with a capital stock of $500,000. The incorporators are Nicholas Ruebeck and others.

SEATTLE, WASH.—Articles of incorporation have been filed for the Seattle-Chelan Spokane Railway Company with a capital stock of $17,000,000. The headquarters of the company will be in Seattle, with branch offices in Spokane, Snohomish and New York City. The trustees are Charles M. Meeker and G. L. Stevens, New York, N. Y.; Mark Mendenhall and John W. Frye, of Spokane; P. P. Carroll, Francis M. Carroll, Charles A. Barron, Elliott Colburn, E. Wright, of Snohomish and E. E. Congdon, of Butte, Mont.

SPOKANE, WASH.—The Cheney Light & Power Company has been incorporated with a capital stock of $25,000 by H. L. Blecker and others.

SPOKANE, WASH.—The Okagogan Electric Railway Company has been organized with a capital stock of $3,000,000, to build an electric line from Nighthawk to Loomis, and ultimately through to Conconcully, North Alma to Brewster.

WENATCHEE, WASH.—The Columbia Power Company has been formed, with a capital of $100,000, by W. T. Clark, Marvin Chase, and F. M. Scheble, to furnish light and power to Wenatchee.

WILLIAMSON, W. VA.—A charter has been granted to the Williamson Traction Company to build an electric railway in Williamson and Mingo counties in West Virginia, and also in Pike and Martin counties in Kentucky.

COON VALLEY, WIS.—The Coon Valley Milling & Lighting Company has been incorporated with a capital stock of $15,000 by N. Neprud and others.

DELAVAN, WIS.—Articles of incorporation have been filed for the Delavan Light & Power Company with a capital stock of $30,000 by Harold Almert and others.

GRAND RAPIDS, WIS.—The Wisconsin Valley Electric Railway Company has filed articles of incorporation to build an interurban railway from Grand Rapids to Stevens Point. The company is capitalized at $25,000, and the incorporators are George A. W. Whiting, of Neenah, and H. F. Whitcomb and George Lines, of Milwaukee.

GRANTSBURG, WIS.—The Farmers Independent Telephone Company has been organized with R. J. Meland as president.

JOHNSON CREEK, WIS.—The Rosk River Telephone Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are W. A. Christians, E. A. Seitz and Eugene L. Christians.

KEWAUNEE, WIS.—The Montpelier Telephone Company has filed articles of incorporation with a capital stock of $1,000. The incorporators are John Zitler, William Goetsch and others.

PRAIRIE DU SAC, WIS.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $5,000 by Edwin Steidtman, Henry Thoelke and Fred Waffenschmidt.

ROSENDALE, WIS.—The Rosendale Telephone Company has been incorporated with a capital stock of $5,000 by F. I. Pinch, R. V. Pinch and Ida W. Pinch.

SPARTA, WIS.—The Sparta-Melrose Electric Railway & Power Company has been incorporated with a capital stock of $300,000, to build an electric railway from the city of Sparta to the village of Melrose, a distance of 20 miles. The incorporators are G. L. Cromwell and T. T. Henderer, of Milwaukee, and Howard Teasdale, of Sparta.

WAUMANDEE, WIS.—Articles of incorporation have been filed for the Waumandee Railroad Company with a capital stock of $125,000. The incorporators are Judge R. S. Cowie, of Whitehall, president; J. M. Smith, of Whitehall, vice-president; F. C. Richmond, of Arcadia, secretary; B. L. Van Cordon, of Taylor, treasurer.

PUYALLUP, WASH.—Puyallup Valley Northern Electric Rapid Transit Company has filed articles of incorporation with a capital stock of $3,000,000. The officers are: Fred J. C. Chamberlain, president; F. S. Martin, first vice-president; Charles H. Fulmers, second vice-president; John Mills, Sr., secretary; August Von Boecklin, treasurer.

FORT SASKATCHEWAN, CAN.—The Fort Electric Company has been incorporated to operate an electric plant to carry on a general electric power business. H. E. Daniel is interested.

VEGREVILLE, CAN.—Ratepayers have joined and formed the Vegreville & Northern Telephone Company for the purpose of constructing a telephone system in this town. The capital stock is $8,000 and the directors include: W. Parker, F. W. Irwin, W. Clements, T. Watt, S. A. Richardson, T. W. Shipley and others, all of Vegreville, Alberta.

DUNSFORD, ONT.—A company has been formed in this place under the name of Dunsford Light & Power Company.

Legal.

AUTHORITY OF PRESIDENT OF CORPORATION TO COLLECT OUTSTANDING ACCOUNTS.—The general authority of the president of a business corporation is sufficient to warrant him in collecting money due the corporation on outstanding accounts and in selling the accounts for their face value. There is no valid distinction between collecting the money from the debtor and assigning the account for its face value. But the president is not authorized by virtue of his office to assign money to become due to the corporation in the future but not yet earned. Cogan vs. Conover Manufacturing Company, Court of Errors and Appeals of New Jersey, 65 Atl. Rep. 484.

METER PATENTS.—The United States Circuit Court of Appeals in Chicago filed an opinion on Jan. 31 last in the case of the Westinghouse Electric & Manufacturing Company vs. the Diamond Meter Company. In this suit, brought for infringement of Tesla patents No. 511,559 and No. 511,560, the Court below granted injunctions against the Diamond Meter Company, stopping its manufacture and sale of alternating-current indicating wattmeters, commonly known to the trade as "Scheeffer Meters," and the present opinion of the Court of Appeals affirms the action of the lower Court in placing the Diamond Meter Company under injunction. This decision is the last of a long series of favorable decisions as to the validity of these patents and their applicability to split-phase meters for power purposes. The opinion gives full credit to Mr. Telsa for the invention of the split-phase idea of operating meters.

TELEPHONE STOCK LITIGATION.—Suits have been filed in East Cambridge, Mass., against Charles W. Morse by Oakes Ames, of Milton, for $250,000; by Frank A. Cutting, of Winchester, for $75,000, and by Arthur S. Temple, of Salem, for $150,000. The plaintiffs say they were formerly officers and directors in the Massachusetts Telephone & Tele-

graph Company, and that they turned over the stock and controlling interest of the company to the defendant on certain promises of his which they say he has failed to fulfill. In November, 1901, they say that the company owned valuable franchises in Boston and thirty adjoining municipalities, and that it undertook to construct and maintain a system between New York and Boston, and that the Cable Company of America undertook to finance the scheme. After the company had advanced $350,000 for the work the funds gave out and work was stopped. At that time Ames and his associates say they turned over 1,271 shares of stock and resigned the control of the company to the defendant, who, they say, agreed to advance $4,000,000 to allow the Cable Company to carry out its agreement and to give the plaintiffs the equivalent of their stock in Cable company stock. The plaintiff allege that the defendant failed to keep his promises and to carry out his agreement.

CONSTITUTIONALITY OF CONDEMNATION STATUTE.—In a proceeding by the Long Distance Telephone & Telegraph Company to condemn a right of way over the Franklin Turnpike, from Nashville to Franklin, Tenn., it was held that the Tennessee Act of 1885, under which the company attempted to condemn its right of way was partially unconstitutional for the reason that the body of the act contained provisions which were not referred to in the caption in any way. The act of 1885 extended the former condemnation statutes so that "the same shall apply to and include the condemnation and taking of the property, privileges, rights or easements of private corporations for public purposes of internal improvements; provided, however, that no telegraph or telephone companies, or other such companies shall be permitted to attach its lines to, or otherwise use the poles of, any other telegraph or telephone company without the consent of such company being first had and obtained." The act then went on to provide for the jurisdiction of certain courts in condemnation proceedings. The caption of the act only purported to extend the operation of the statutes amended to the condemnation of the property of private corporations and it was the jurisdictional provision which was held unconstitutional. It was held, however, that the invalidity of this part of the act did not affect the remainder of it. The provisions of the act were severable and the portion of it which was unconstitutional, it was held, might be eliminated, leaving intact that part which extended rights of condemnation so as to include the taking of property belonging to private corporations. Franklin Turnpike Company vs. Long Distance Telephone & Telegraph Company, Supreme Court of Tennessee, 99 S. W. Rep. 373.

LIABILITY OF ELECTRIC LIGHT COMPANY TO FIREMAN INJURED WHILE ON DUTY BY CONTACT WITH LIVE WIRE.—At a fire which occurred in the city of Omaha, Neb., four firemen were instantly killed by means of an electrical charge which it was claimed was communicated from one of the defendant company's wires to a ladder which the firemen were engaged in removing from between the wires. In an action brought by the administrator of one of the firemen to recover damages for his death, it appeared that the chief of the fire department and the city electrician had sole charge of removing the wires of the defendant company during the time of the fire, and that the lineman, who was furnished by the company to attend at places of fire, acted under the direction of the fire chief and the city electrician and not as the agent of the defendant. The plaintiff alleged that the company sent another employe to repair and restore wires removed during the fire and to prevent the unnecessary destruction of the company's property. This employe, it was stated, informed the firemen as they were about to remove the ladder that the wires near the ladder were dead, and the right to recover was based upon his negligence in making the statement. It was held, however, that as the employe was not sent to co-operate with the officers of the fire company and as there was nothing in the scope of his agency which would bind the company for an opinion he might express as to whether the wires were dead or alive, the company could not be held responsible in damages for the death of the fireman. Trouton vs. New Omaha Thomson-Houston Electric Light Company, Supreme Court of Nebraska, 110 N. W. Rep. 569.

DAMAGES FOR FAILURE TO DELIVER TELEGRAM.—The Court of Civil Appeals of Texas has recently affirmed a judgment of $1,000 against the Western Union Telegraph Company because the agent of that company occupied three hours and ten minutes in the delivery of a telegraphic message. The plaintiff, in anticipation of the death of a near relative, had arranged to be notified of any serious change by telegram. A message, announcing the death of the relative, was left with the defendant company and the agent was informed of the facts and circumstances requiring its speedy transmission. The message was received by the agent at Sanderson, Texas, where the plaintiff lived, at 6:20 in the morning. Although the plaintiff lived but a short distance from the telegragh office, the message was not delivered until 9:30. And as the daily train out of Sanderson left at 8:25 the plaintiff was unable to start for the scene of his relative's funeral until the next morning. She left on the following morning, but only to arrive at her destination after the burial ceremony was over, and to compensate her for the great bodily and mental pain, disappointment and grief which was thereby occasioned the jury awarded her the sum mentioned in damages. Western Union Telegraph Company vs. Hidalgo, 99 S. W. Rep. 426.

DUTY OF EMPLOYE TO INSPECT TOOLS AND APPLIANCES.—A mining company, desiring to dig a pit at the bottom of a long incline, assigned several of its employes to the work. The earth and stone removed was thrown into a car which, when full, was hauled up the incline by means of machinery, there being a long wire rope attached to a clevis fixed in the end of the car. The clevis, it was admitted, became insecure and unsafe for the use which was being made of it and, when the car was being hauled up the incline, it broke, allowing the car to run back with great violence, severely injuring one of the employes. While there was evidence that the employe was a mine boss, charged with a duty of looking after the safety of the machinery and appliances used in the work, and that he had knowledge of the defect in the clevis which caused the accident, the jury found that he was an ordinary laborer and was unaware of the dangerous condition of the clevis. If the employe, at the time he was injured, was acting in the capacity of mine boss, and as such had charge of and supervision over the tools and implements used in the work, he could not recover damages from the company for injuries sustained by reason of any defect in such appliances which it was his duty to inspect. But, unfortunately for the company, the jury found that the employe was a common laborer and not a mine boss vested with supervision over the machinery and tools. Such being the case, it was the duty of the company to have supplied its employe with a reasonably safe place in which to work and with reasonably safe appliances with which to do the work. The company having failed in this duty it was liable for damages and the sum of $1,999 was granted to the injured employe. Nortonville Coal Company vs. Brooks, Court of Appeals of Kentucky, 99 S. W. Rep. 357.

RIGHT OF CORPORATION TO INJUNCTION RESTRAINING INVASION OF ITS FRANCHISE.—In an action brought by the Millville Gas Light Company for the purpose of restraining the Vineland Light & Power Company from laying its gas pipes in certain highways in Cumberland County, New Jersey, it appeared that the complainant, the Millville Company, operated under an act of legislature passed in 1857, authorizing it to place its pipes and erect its poles in "the town of Millville and its vicinity." The act of the Vineland Company of which the Millville Company complained was the laying of pipe in highways situated within territory that in 1857 was known as the township of Millville, but beyond the limits of what was at that time the village of Millville. It was claimed that the Vineland Company was without right, either by legislative or municipal authorization, to conduct business as a gas company or to occupy any streets or highways for that purpose. In determining whether or not the act of the Vineland Company constituted an invasion of the Millville Company's franchise the interpretation of "the town of Millville and its vicinity" became material, for if the Millville Company had no power to operate within the contested territory, then it followed that it was not in position to restrain its competitors from doing so. The word "town" in legislative enactments seems to have no fixed significance in New Jersey and must be construed according to the manifest intention of the legislative body as gathered from the particular statute before the court for interpretation. It was here held that the intent of the legislature in passing the act of 1857 was to authorize the Millville Company to operate in the village of Millville and its vicinity and not in the entire township and its vicinity. The interpretation of the word "vicinity" was regarded as more difficult, but it was held that it did not include the entire township. The conclusion of the court was that it did not appear with sufficient certainty that the Millville Company was the owner of a franchise covering the territory in dispute to justify the granting of an injunction against the Vineland Company. If the complainant company had established its right to carry on its business in the territory in question it would have been entitled to the relief asked as is evidenced by the following language of the court: "Legislative grants of franchises of the nature claimed by the complainant, whether granted by special charters or under general laws, confer privileges which are necessarily exclusive in their nature as against all persons upon whom similar rights have not been conferred, for any attempted exercise of such rights, without legislative sanction, is not only an unwarranted usurpation of power, but operates as a direct invasion of the private property rights of those upon whom the franchises have been so conferred." Millville Gas Light Company vs. Vineland Light & Power Company, Court of Chancery of New Jersey, 65 Atl. Rep. 504.

Educational.

THESES SUBJECTS.—The theses subjects in electrical engineering recently announced for the class of 1907 at the University of Illinois are as follows. The list comprises twenty theses subjects and thirty-five graduates: "Testing of Electric Railway Bonds," B. T. Anderson and W. L. Egy; "Operation of a 100,000-Volt Transformer," J. W. Andree and Trygve Jensen; "Comparison of Recent Types of Secondary Batteries," C. H. Bethel; "Synchronizing and Load Divisions of Alternators," R. A. Brooks and H. C. Gardner; "Life Tests of High Efficiency Incandescent Lamps," R. T. Calloway and L. G. Schumacher; "Operation of the Derby Dust Collector in Traction Service," L. P. Cook; "Determination of Plate and Brake Friction in Railway Trucks," T. F. Dodd and W. F. Schroeder; "Design and Construction of a Homopolar Dynamo," S. P. Farwell, E. H. Johnston and A. E. Ray; "Design of a Power Plant for Urbana," H. C. Fellman and M. E. Hagan; "Induction Motors in Concatenation," R. O. Friend and V. L. Hollister; "Use of Coreless Inductances in the Operation of Synchronous Machines," Lloyde Garrison and G. A. Williams; "The New Stanley Induction Wattmeter," S. H. Grauten; "Equipment of a Shunt Motor with Interpoles," H. G. Hake and H. G. Treichel; "Effect of Track Curvature in the Operation of Electric Cars," J. O. Kammerman and D. G. Young; "Telephonic Communication Over the Power Circuit with an Electric Car," W. C.

Maddox and F. W. Padfield; "Design and Prospectus for a Telephone System for Dixon, Illinois," D. T. Marks; "The Design, Construction and Operation of a Gradeometer for Electric Test Cars," C. M. Page; "Tests of a Ten-Ton Electric Crane," A. J. Ray; "Light Distribution and Tests of New Types of Incandescent Lamps," W. R. Scott and O. M. Ward; "Coreless Induction Coils in Telephone Service," C. E. Smith and W. M. Stewart.

Obituary.

MR. H. J. LINDSAY.—Mr. Homer J. Lindsay, one of Mr. Andrew Carnegie's forty young partners, died at his home at Pittsburg, on March 5, aged 47 years, of Bright's disease. He was the son of Samuel Lindsay, a glassmaker who, although quite well off at one time, died very poor. The son learned telegraphy and stenography and at the age of 18 he entered the office of Carnegie Bros. He won attention from Thomas M. Carnegie, who made him his private secretary. Mr. Lindsay remained in that position until the death of Mr. Carnegie, after which he became connected with the sales department of the company. When the Carnegie Steel Company was formed he had become so useful that he was taken in as one of the "young partners," all of whom were afterward made millionaires when the United States Steel Corporation was formed. Mr. Lindsay added to his fortune and was many times a millionaire. At the time of his death he was assistant vice-president of the Carnegie Steel Company. He was a member of many clubs, including the Transportation, Engineers and Strollers clubs of New York. His wife and two sisters survive.

Personal.

MR. M. F. UNDERWOOD has been made commissioner of electric lines and lights at Somerville, Mass., and has qualified for the office.

MR. CHARLES H. HILL has resigned as chief engineer of the Northampton Electric Company to accept the position of assistant superintendent of the Poughkeepsie Electric Light Company, Poughkeepsie, N. Y.

MR. A. L. CORNELL, of Birmingham, Ala., has been elected resident engineer of the Ninety-Nine Islands station, near Kings Creek, S. C., of the Southern Power Company, on the Broad River, and has taken charge of the work.

MR. C. L. ESHLEMAN, who has been associated with the Stanley-G. I. Electric Mfg. Co., at Pittsfield, Mass., has been elected secretary of the Jandus Electric Co., of Cleveland, O. Mr. Eshleman's familiarity with the electrical industry insures his success in his new connection.

MR. FRED. F. BAHNSON, formerly with the Stanley Electrical Mfg. Co., and recently chief electrician of the Florida East Coast Hotel Co., has given up electrical work to take charge of woolen mill and other manufacturing interests of the firm of F. & H. Fries, Winston-Salem, N. C.

MR. B. H. BROOKS, superintendent of the Citizens' Telephone Company, at Columbus, Ohio, has resigned to become construction engineer of the Home Telephone Company, of Detroit, Mich., of which W. B. Woodbury, formerly of Columbus, is general manager. Roy Owens has been appointed superintendent to succeed Mr. Brooks at the Columbus plant.

MR. R. W. HUTCHINSON, JR., whose technical work, "Long-Distance Electric Power Transmission," has just been published by the D. Van Nostrand Company, of New York, has an article in the March issue of "Public Service" on "The Question of Municipal Ownership," in which public-owned utilities are heavily scored. Mr. Hutchinson is on the staff of the National Brake & Electric Company, of Milwaukee.

MR. E. H. NAGELSTOCK, connected formerly with the sales department of the General Electric Company of New York City, has joined the forces of the Gregory Electric Company, and will hereafter represent that company in Chicago and the nearby cities. He is a graduate of the Armour Institute of Technology and has had considerable experience with the General Electric Company, first in the testing department at Schenectady, then as engineer of the complaint department, and finally as a salesman engineer from the New York office. In these various capacities he has made a great many friends and valuable acquaintances.

MR. JOHN CRAIG HAMMOND, for some time at the head of the publicity department of the Denver Gas & Electric Company, and later associated with the electrical interests of Mr. H. L. Doherty, with headquarters in New York, has now been appointed press representative of the New York Central lines, with headquarters at the Grand Central Station. Mr. Hammond is a young and brilliant journalist, and in his new responsibilities will find a large opportunity for his skill, diplomacy and savoir faire as an exponent of the railroad systems ideals, methods and relations with the public.

MR. WILLARD N. SAWYER has been chosen president of the Wellman-Seaver-Morgan Company, of Cleveland, to succeed Samuel T. Wellman, who wishes to retire as the active head of the company. Mr. Wellman has felt severely the loss of his brother, who was killed in the Mentor wreck a year ago, with his business associate, Mr. Morgan. Mr. Sawyer has been general manager of the business since the first of the year. This position he will continue in connection with the duties of president. He began life as an engineer and has risen rapidly. He went to the Wellman-Seaver-Morgan Company from a position at the head of a large power company.

PROF. F. R. HUTTON.—At the last meeting of the trustees of Columbia University, upon his own request, action was taken to retire from active service Frederick Remsen Hutton, for thirty years adjunct professor and professor of mechanical engineering and for six years Dean of the Faculty of Applied Science, and to appoint him emeritus professor from July 1. Prof. Hutton is now president of the American Society of Mechanical Engineers.

MR. J. G. ROSSMAN, consulting engineer, formerly of Peters Building, Atlanta, Ga., has returned from an extended trip to California, Northwest and Black Hills district of South Dakota, and has taken offices in Broad Exchange Building, 25 Broad Street, New York. While in the West he visited a number of electric and water power plants, and inspected some of the properties he is interested in. He will continue to handle water power and electric properties, making a specialty of examinations, reports, and verification of reports on public utilities, especially water power and electric, for banking houses, trust companies and investors.

MR. C. B. SMITH.—The resignation of Mr. Cecil B. Smith from his position as a member of the Ottawa Hydro-Electric Power Commission has been accepted. To replace him Mr. W. K. McNaught, who represents North Toronto in the Ottawa Legislature, has been appointed to the body, which is engaged in carrying out the government's policy of procuring cheap power for the people of the province. It is now several weeks since Mr. Smith expressed a desire to retire from the commission. His reason for so doing was that the pressure of his business as an engineer demanded all his time. He is in charge of the construction of the municipal power plant for the city of Winnipeg. He will be continued as consulting engineer for the commission, as he is for the first Hydro-Electric Power Commission of Inquiry and for the Temiskaming and Northern Ontario Railway Commission.

MR. ARMIN SCHOTTE.—Mr. Schotte, who has had wide experience in industrial plant design, has recently made a connection with W. S. Barstow & Company, of New York and Portland, Ore. Graduating from Lehigh University with the degree of C. E., he became connected with the engineering departments of such firms as the Keystone Bridge Works, and the Carnegie Steel Company, subsequently was chief engineer of the Expanded Metal Type Company and the National Fire Proofing Company, of Pittsburg. As consulting and designing engineer he has built many industrial plants, among the more prominent being the Mesta Machine Company, of Pittsburg, Pa., which is one of the larger individual manufacturers of rolling mill machinery in this country, and latterly was connected with the Alpha Portland Cement Company and the National Portland Cement Company.

MR. WERNER BOECKLIN.—One of the principal figures in the recently increased organization of W. S. Barstow & Company is that of Mr. Boecklin, who has filled responsible positions in the engineering department of the "Fort Wayne" and "Burlington" systems in connection with important and extensive improvements as engineer. As engineer for the Robins Conveying Belt Company, and John A. Mead & Co., of New York, he designed a large number of important material handling plants, among which may be mentioned those for the Dominion Coal Company, Jones & Laughlin Steel Company, Chicago Edison Company, Washington Navy Yard; Fifty-ninth Street power station of the Interborough system, and the Chelsea station of the London Underground Railways Company. Since his connection with the Barstow Company he has been engineer in charge of construction of the steel car shops, Middletown Car Works, Middletown, Pa., which they are just completing.

MR. J. R. LOVEJOY has been appointted general manager of the sales department of the General Electric Company. He has long been known to the electrical fraternity and this new title is a formal recognition of the responsibilities with which he has practically been charged for the last two or three years. Mr. Lovejoy was born at Columbus, O., in 1863. After a post-graduate course at the Ohio State University, from which he received the degree of B.Sc., he entered the employ of the Thomson-Houston Electric Company at Lynn, Mass., August, 1886. There he gained his practical experience and graduated from what was then known as the "expert course" to take up engineering work in the Boston office of the company. Later his time was devoted to executive duties at headquarters, and when the Thomson-Houston Company was merged into the General Electric Company, in 1892, he became general manager of the supply department. In 1900 he was made also manager of the railway and lighting departments of the General Electric Company. He is an officer and a director in several subsidiary companies. Mr. Lovejoy is a director and a member of the executive committee of the Schenectady Trust Company and was one of the organizers of that concern. He is also a member of the American Institute of Electrical Engineers, the Franklin Institute, and the American Society for the Advancement of Science, as well as several organizations pertaining to electrical science. In addition to his diversified duties, Mr. Lovejoy finds time to take an active part in promoting the welfare of the Mohawk Golf Club of Schenectady, of which he is president. He is also a member of the Mohawk Club, of Schenectady, and the University Club of New York. For many years Mr. Lovejoy has been interested in the subject of archæology so far as it is related to implements of the stone age, particularly Indian arrow heads, of which he has made a notable collection. Mr. Lovejoy's home and principal office are still situated, as for several years past, at Schenectady.

Trade Publications.

ICE MAKING.—The Westinghouse Electric & Mfg. Co. has issued a pamphlet devoted to the Larsen ice machine as driven by its motors. These plans have a capacity of from two tons upward. The "baby" machine, equal to about three tons daily, occupies a floor space of only 4½ x 4½ x 16 feet.

VENTILATED AND ENCLOSED RHEOSTATS.—The Cutler-Hammer Mfg. Co., Milwaukee, Wis., has issued a well-prepared booklet, entitled "A Tale of Two Types," which gives a detailed comparison of the two types of starting rheostats, commonly known as "ventilated" and "enclosed." It is stated that for field rheostat and switchboard work the enclosed types are usually preferred; for all other classes of work, but particularly for motor starting, the ventilated type has become standard. As the resistance material for the ventilated types of standard starting rheostats, iron is universally employed. The booklet draws attention to the fact that an amendment to the National Electrical Code, recently proposed by a sub-committee of the National Board of Fire Underwriters, which would require the use for starting rheostats of small or medium size of a resistance material having a zero resistance-temperature coefficient, would prevent the use of iron for such purpose. It is stated that iron possesses many inherent characteristics which render it especially suited for such purpose, and that the amendment would require manufacturers to use more expensive materials with greater cost to the purchaser without any compensating gain.

Business Notes.

THE GREGORY ELECTRIC COMPANY, of Chicago, reports the second-hand business to be in an exceptionally prosperous condition, shipments during January and February having been the largest in the history of this company, and the prospects for the coming year being exceptionally bright. This company is now getting the full benefit of being in its own specially equipped works, where it has plenty of room for handling electrical machinery and a chance for further growth.

THE ELECTRIC SERVICE SUPPLIES COMPANY, of Philadelphia and Chicago, wishes to announce that in addition to the territory of Philadelphia and Chicago which it already controls, it has been given the territory surrounding Pittsburg for the full line of Sterling insulating material. A full stock of varnish, black plastic insulator, etc., will hereafter be carried in stock at its new Pittsburg warehouse. Sterling insulating varnish has won a place of prominence in the electric railway field, and this announcement will be welcomed by customers in the Pittsburg territory.

VALVES AND GAUGES.—The Chicago office of the American Steam Gauge & Valve Mfg. Co., which has been located for the past 20 years at No. 16 North Canal Street, has been removed to new and commodious quarters at Nos. 7-9 South Jefferson Street, where with increased floor space the company will be able to carry a much larger stock of its staple goods and specialties than ever before. A large assortment of gauges of every description, a complete line of brass pop safety valves, water relief valves and indicators will be carried in stock at all times. Owing to the increased business of the company it was compelled to move in larger quarters and at the new location will be able to supply the trade in a very satisfactory manner.

APPARATUS FOR SALE.—The F. Wesel Mfg. Company, located at 70 to 80 Cranberry Street, Brooklyn, N. Y., which has one of the best equipped manufacturing plants in the country, has decided to dispense with its engine room, having recently become a customer for the Edison current, as described in these pages. It now has for sale the engines complete with generators, and a storage battery equipment. All of these can be bought at a very reasonable figure. This plant was installed only a little over a year ago and the condition of the machinery offered is as good as new. The entire outfit is open for inspection and can be seen at any time at the Wesel Company's plant, 70 to 80 Cranberry Street, two blocks from the old bridge, Brooklyn, N. Y. The plant was fully illustrated in the ELECRICAL WORLD of October 20, 1906.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAR. 5, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 140 Nassau St., N.Y.]

845,740. COMMUTATOR BRUSH FOR DYNAMO MACHINES; Robert N. Baylis, Englewood, N. J. App. filed Apr. 10, 1905. The brush is clamped to a frame or rocker arm so as to be adjustable thereon for wear. A permanent flexible connection is made between the brush and the arm so as to keep the electrical conductivity perfect.

845,754. LAMP SOCKET; Charles A. Chase, Chicago, Ill. App. filed Dec. 29, 1906. A lamp socket of the type adapted to be clamped on a sheet metal support for electric signs and similar purposes. The socket is in the form of a two-part clamp engaged through openings in the metal plate.

845,796. MULTIPLEX TELEPHONY; Jacob W. Lattig, Wyncote, and Charles L. Goodrum, Philadelphia, Pa. App. filed Mar. 3, 1904. In a telephone system, line-circuits, double-wound coils having their respective windings included in said circuits, and means interpolated in the windings of each coil to increase the self-inductance of the coil and the circuit, substantially as described.

845,831. MOTOR CONTROLLER; Thomas S. Watson, Milwaukee, Wis., App. filed July 12, 1906. Complete diagram of circuits for a motor controller adapted to control either one of a plurality of motors at will.

845,836. ELECTRIC IGNITER; John D. Wilmot, Denver, Col. App. filer Aug. 29, 1906. A hand sparking device in the form of a pair of tongs is connected to a battery circuit including a spark coil so that gas furnaces, ranges, etc., my be ignited without danger.

845,848. ELECTRICAL SWITCH; Ernest W. Brackett, Elyria, O. App. filed Mar. 31, 1904. A form of telephone hook switch having connections with the spring blades which constitute the electric contact making devices.

845,856. METHOD OF AND APPARATUS FOR BRAKING VEHICLES; George H. Condict, Plainfield, N. J. App. filed May 9, 1906. Diagram of controller circuits for an electric train in which the motors are utilized as generators for a braking current.

845,858. COMBINER SOUNDER AND RESONATOR; Stewart F. Cox, Sallisaw, I. T. App. filed Apr. 10, 1906. A combined apparatus adapted to do the work of a relay sounder and resonator. The parts are mounted in a specially constructed resonant box.

845,890. ELECTRICALLY-DRIVEN STEP-BY-STEP MACHINE; Arthur F. Poole, Wheeling, W. Va. App. filed Oct. 22, 1902. A secondary clock having a positively actuated ratchet movement to propel the hands and a V-shaped electromagnet by which the intermittent movement is secured from the circuit of a master clock.

845,894. THERMOSTAT; Henry E. Reeve, New York, N. Y. App. filed Feb. 2, 1906. Details of the means for leading in the circuit wires to the casing of a thermostat device so as to prevent the ingress of moisture with consequent corrosion. The wires are sealed into L-shaped passages.

845,896. SPEED VARYING MECHANISM; Gustaf T. Rennerfelt, Scranton, Pa. App. filed June 8, 1905. Construction of controller for motors designed to drive machine tools. Has a plurality of magnetic clutches with different gear combinations together with the usual circuits for varying the motor field strength.

845,900. TROLLEY WHEEL AND HARP; Edward S. Roland, Cleveland, Ohio. App. filed Oct. 19, 1905. The trolley wheel is made with a separate tread portion and flanges so that the tread may be renewed whenever it becomes worn. The bearings are also bushed with replaceable boxes.

845,922. FREQUENCY AND VOLT INDICATOR; Joshua F. Begole, St. Louis, Mo. App. filed Aug. 31, 1906. In a frequency and volt meter, the combination with a movable coil, of a movable scale controlled thereby, a condenser in series with said coil, a stationary scale, a second movable coil, a resistance in series with said coil, and a pointer controlled by said second coil and co-operating with said movable scale to indicate frequency and with said stationary scale to indicate voltage.

845,956. FREQUENCY-INDICATOR; Alexander S. Langsdorf, St. Louis, Mo. App. filed Sept. 6, 1906. In a frequency-meter, the combination with a pair of co-operative indicating devices, of means for moving one of said indicating devices proportional to the voltage and frequency of the current to be measured, and moving the other of said indicating devices proportional to the voltage of the current to be measured.

845,974. OUTLET BOX, ELECTRIC CONDUCTOR; Raymond S. Parsons, East Hampton, N. Y. App. filed Nov. 12, 1906. Provides an outlet box having a plurality of radial wire receiving tubes or bushings formed integral therewith, thus dispensing with the employment of detachable couplings.

845,991. ALARM SIGNAL; Robert J. Zorge, Chicago, Ill. App. filed Feb. 28, 1906. A device adapted to be placed adjacent to the track rails of a railroad by which torpedoes are automatically fed into a position to be exploded when a train passes in case a switch in advance of the train is open.

845,995. ELECTRICAL MEASURING INSTRUMENT; Adelbert O. Benecke, Newark, N. J. App. filed Nov. 28, 1905. Relates to measurement of direct currents or alternating currents of any frequency or wave form. Utilizes the varying expansion of dissimilar metals to move a pointer on a scale. The scale is positioned in a similar way so as to automatically correct for atmospheric temperature changes.

845,996. SHUNT FOR ELECTRICAL MEASURING INSTRUMENTS; Adelbert O. Benecke, Newark, N. J. App. filed Dec. 9, 1905. In order to keep the resistance shunt of an ammeter or similar instrument cool, patentee has the resistance strip clamped between massive plates of metal but insulated therefrom.

845,997. ELECTRICAL RESISTANCE; Adelbert O. Benecke, Newark, N. J. App. filed June 1, 1906. Relates to modification of the above.

846,018. CONTROLLING DEVICE FOR GAS GENERATORS; Fritz Durr, Karlsruhe, Germany. App. filed Mar. 26, 1906. Relates to a device for gas generators which allows a constant control whether the generator supplies a good gas or as to whether it supplies a bad gas from which an explosion is likely.

846,068. ACOUSTICON; Kelley M. Turner, New York, and Norton W. Johnston, Chappaqua, N. Y. App. filed Aug. 25, 1905. A form of telephone transmitter adapted to be placed in the center of a room so as to receive all sounds equally from whatever direction they may come. The essential feature is to have a plurality of transmitters inset into the faces of a box of triangular section. The properties of a triangle are such as to receive the sound equally from all directions.

846,081. RECEIVER; Louis W. Austin, Washington D. C. App. filed Oct. 27, 1905. In a system of signaling, a receiver consisting of a thermo-couple having as its elements tellurium and silicon.

846,084. ELECTRICAL MEASURING INSTRUMENT; Adelbert O. Benecke, Newark, N. J. App. filed Dec. 13, 1906. A safety device embodied in measuring instruments which prevents the injury or destruction thereof when measuring currents of unknown values.

846,114. ELECTRICAL WINDING; Jacob W. Lattig, Wyncote, and Charles L. Goodrum, Philadelphia, Pa. App. filed March 3, 1904. Relates to systems and methods of operation involving the use of double wound coils which are closely enough associated mechanically and have sufficient difference of potential between their several parts

to make their static capacity invariable. Is wound in sections or wafers.

846,120. ELECTRICAL SWITCH; Ray H. Manson, Elyria, O. App. filed Mar. 31, 1904. Relates to details of construction of a telephone hook switch of which the parts are stamped from sheet metal.

846,122. RAIL BOND; George A. Mead, Mansfield, O. App. filed Nov. 23, 1904. The bond is made of superposed ribbons or strips of copper which are sheathed in a copper envelope at their ends.

846,144. POLE-DISTRIBUTION RACK FOR TELEPHONE SYSTEMS; William Robinson, Muskegon, Mich. App. filed May 3, 1906. A wire-distribution bracket composing spaced securing parts, means connecting said parts, and a plurality of abutting-insulating spools carried in axial alignment by said means.

846,158. SOCKET BUSHING OR FITTING FOR ELECTRICAL PURPOSES; William B. Stewart, Philadelphia, Pa. App. filed Aug. 9, 1906. The circuit wires are led into the socket through a split insulating button so that the latter may be applied to the connection so made.

846,185. ELECTRICAL INDICATING DEVICE; Charles Crandall, Newport, R. I. App. filed June 2, 1906. Relates to electrically controlled block signal systems. Consists in insulating the sections of the rails from one another and placing the joints in staggered relation so that the truck of a small car, such as a hand car, will not operate the signals.

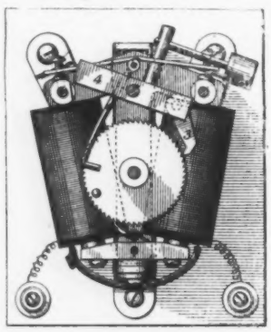
846,205. TROLLEY HARP; Charles and Warren Hibbard, Sandy Hill, N. Y. App. filed Feb. 28, 1906. The trolley harp is built up of special sheet metal stampings which are locked together by a single thumb screw or nut. In this way the parts are easily disassociated to renew the wheel when desired.

846,214. VOLTAGE REGULATOR FOR ALTERNATING CURRENT GENERATORS; Frederick R. Keller, Lancaster, Pa. App. filed Oct. 22, 1906. Provides for regulating the voltage of an alternating-current generator so as to maintain it substantially constant under operating conditions either at the generator terminals or at a distant point.

846,223. MEANS FOR MAINTAINING CONSTANT THE VOLTAGE OF AN ELECTRIC CIRCUIT; Thomas Marshall, Chicago, Ill. App. filed Jan. 10, 1907. Relates to circuits and devices for maintaining constant the voltage of an electric circuit. Has for its primary object to provide improvements whereby as the voltage of the circuit falls below a certain value, the deficiency will be automatically supplied.

846,227. ELECTRIC MOTOR; David Mendelson, Brooklyn, N. Y. App. filed Jan. 25, 1907. An advertising device for a store window adapted to strike a bell to oscillate a movable finger. Has an iron-clad magnet with a specially-shaped armature, but having a wide arc of vibration.

846,276. ELECTRIC SIGNAL CONTROL; Mathew Abt, New York, N. Y. App. filed Mar. 26, 1906. Relates to signal control system for elevators of the type having "up and "down" buttons on each floor which light a lamp as the car approaches.



845,890.—Electrically-Driven Step by Step Machine.

846,327. CALLING DEVICE FOR TELEPHONE-EXCHANGES; Frank A. Lundquist, Chicago, Ill. App. filed June 13, 1904. The combination with a contact-making device, and a source of power for operating it, of a receiver-hook, means by which an ascent of said hook will set said device preliminary to the making of a contact thereby, and means by which a descent of said hook will release said device.

846,328. REGISTERING DEVICE FOR TELEPHONE-EXCHANGES; Frank A. Lundquist, Chicago, Ill. App. filed Oct. 20, 1904. The combination with the local stations and the electrically-operated switching mechanism of an automatic telephone-exchange, of a registering device at each local station, and means by which the registering device of a calling station is operated by a response being received from a called station.

846,336. AUTOMATIC FIRE SIGNAL SYSTEM; Robert L. McElroy, John E. Shepherd and James G. Nolem, Chicago, Ill. App. filed Dec. 12, 1903. An automatic fire signal system adapted to transmit to a central station a predetermined signal in the event of the existence of undue heat conditions in the area protected by the system.

846,340. ELECTRIC SWITCH MECHANISM; Frank C. Newell, Wilkinsburg, Pa. App. filed Apr. 4, 1902. The switch contacts are enclosed within a shield or casing and are magnetically moved in such a way as to cause the circuit rupture in a magnetic field. Has a winding holding the contacts together and a stronger winding tending to move them apart and a shunt for short circuiting the latter winding.

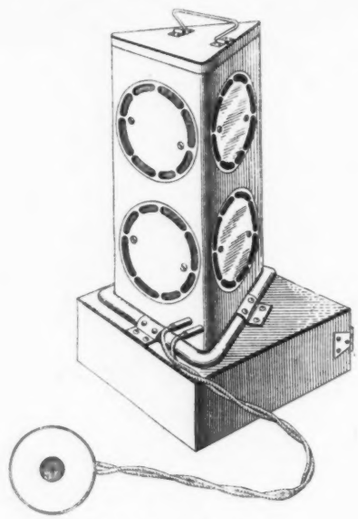
846,354. CURLING IRON; George F. Shields, Kern, Cal. App. filed Aug. 19, 1905. The usual bar or body of a curling iron is made hollow and a resistance wire is inserted therein and embedded in plastic material.

846,365. AUTOMATIC TROLLEY RETRIEVER; Robert J. Walker, Anderson, Ind. App. filed Jan. 13, 1906. The retrieving drum is mounted on a worm shaft so that in case of excessive unwinding movement it will move laterally to impinge against a trip and cause a retrieving spring to act.

846,368. TELEPHONE SIGNALING DEVICE; Klas Weman, Buffalo, N. Y. App. filed Jan. 23, 1906. Details of construction of a telephone bell ringer having a permanent magnet with two magnetically wound poles and an armature pivoted between them and having a bell clapper fixed thereto.

846,378. WIRE RETRIEVING ATTACHMENT FOR TROLLEY WHEELS; William C. Althen, Columbus, Ohio. App. filed Apr. 2, 1906. The harp has a pair of arms which are pivoted to move upward so as to overlie the trolley conductor. These are displaced by the contact with the hangers in passing.

846,381. TELEPHONE-EXCHANGE; Clarence A. Anderson, Salina, Kans. App. filed Jan. 3, 1905. In a party-line exchange, the combination with a battery by means of which the party-line is operated



846,068.—Acousticon.

so as to establish telephonic connections between stations, of a line-drop for indicating calls on the line and means by which an operation of said drop will disconnect said battery from the line.

846,382. SWITCHING MECHANISM; Clarence A. Anderson, Salina, Kans. App. filed Jan. 29, 1906. Details of the switch mechanism for a telephone exchange having a U-shaped permanent magnet and winding contained therein so as to constitute a polarized relay.

846,394. TELEPHONE SYSTEM; Charles G. Burke and Edward J. Burke, Brooklyn, N. Y. App. filed Oct. 14, 1905. In a telephone system the combination of a subscriber's station and a central station, a line-annunciator lamp, means controlled by the subscriber and the operator for varying the light of the lamp.

846,400. CLAMP FOR GROUND WIRE ELECTRICAL CONNECTIONS; Warren R. Cox, Cleveland, Ohio. App. filed Feb. 19, 1906. A strip or band of metal has a stud at one end and a number of perforations at the other so as to surround and be engaged upon any size of cable.

846,404. ELECTRIC FUSE; Louis W. Downes, Providence, R. I. App. filed Dec. 8, 1903. Relates to enclosed fuses of the type having projecting terminals adapted to engage circuit terminal clips. The heads of the fuse tube are specially stamped so as to constitute a very rigid support for the terminals.

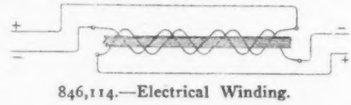
846,413. TELEPHONE SYSTEM; Isidor Kitsee, Philadelphia, Pa. App. filed Apr. 8, 1904. Relates to circuits of a telephone system having annunciators by which different subscribers of the same party line are notified of their particular call.

846,414. RECEIVING DEVICE FOR ELECTRIC TRANSMISSION; Isidor Kitsee, Philadelphia, Pa. App. filed Apr. 10, 1905. Has a pair of coils each connected to a source of alternating current and a source of direct current, the action of one of said coils nullifying the other, and a means to vary the nullifying effect in accordance with the impulses received.

846,415. TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed Feb. 26, 1906. Relates to the transmitting device utilized with a submarine telegraph system. Has a pair of local circuits each containing an electromagnet, one opened and closed through the key switch and the other through the key lever.

846,416. TELEGRAPHIC RECEIVING DEVICE; Isidor Kitsee, Philadelphia, Pa. App. filed Sept. 6, 1906. Relates to receiving or recording devices for submarine telegraphy. Aims to translate the incoming impulses on lines with great capacity into a local sounder, or to relay the same to a second submarine cable.

846,422. DYNAMO-ELECTRIC MACHINE; Ernst Oelschlager, Charlottenburg, Germany. App. filed Dec. 10, 1904. In a motor-starter, the combination of a continuous-current motor, a continuous-current



846,114.—Electrical Winding.

starting-dynamo in series with said motor, a permanent resistance of small inductance in series with the field of said dynamo, and means for varying and reversing the current in the field of said dynamo.

846,427. ALTERNATING-CURRENT MACHINE WITH COMMUTATORS AND WITH COMPENSATING WINDINGS; Rudolf Richter, Charlottenburg, Germany. App. filed Aug. 28, 1906. The combination, in an alternating-current machine of the type described, of an armature-winding, a compensation-winding connected in series thereto, a field magnet winding connected to said compensation-winding, means connected electrically directly with said compensation-winding adapted to produce a difference of potential between one part of the compensating-winding and another part of the same whereby an auciliary field is produced, for the purpose specified.